Practice of Architecture: Containing the Five Orders of Architecture and an Additional Column and Entablature

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PRACTICE OF ARCHITECTURE.

CONTAINING

THE FIVE ORDERS OF ARCHITECTURE,

AND

AN ADDITIONAL COLUMN AND ENTABLATURE,

WITH ALL THEIR

ELEMENTS AND DETAILS EXPLAINED AND ILLUSTRATED,

FOR THE USE OF

CARPENTERS AND PRACTICAL MEN.

With Sixty Plates.

By ASHER BENJAMIN, Architect,

Author of "The American Builder's Companion," "The Rudiments of Architecture," and "The Practical House Carpenter."

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1833.

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PREFACE.

I have endeavored, in this Treatise, to avoid a defect which is very generally complained of in books of this kind; that is, a want of particularity in the details, and of a clear, simple explanation of them. In cities, where Architects are always at hand, this deficiency is not so much felt; since the Carpenters there stand in need of no further knowledge upon the subject, than such as may enable them to put into practice the drawings furnished by the Architect. But in villages, the case is different. Those Carpenters in country villages who aspire to eminence in their business, having no Architect to consult, are under the necessity of studying the science thoroughly and without a master. To them, therefore, is this book peculiarly adapted; for it contains the principles of many expensive folios, condensed into a narrow space and applied to modern practice.

The time has been, within my own recollection, when New England did not contain a single professed Architect. The first individual who laid claim to that character, was Charles Bulfinch, Esq. of this city; to whose classical taste we are indebted for many fine buildings. The construction of the Franklin Street houses, of which that gentleman was the Architect, gave the first impulse to good taste; and Architecture, in this part of the country, has advanced with an accelerated progress ever since. But though Architecture has certainly improved, and rapidly, too, within late years, a large proportion of the vast number of buildings which meet the eye, of

all classes and sizes, and constructed for all purposes, are totally destitute of architectural taste. This defect does not arise from parsimony; for it is not uncommon to see buildings of large dimensions burdened with a profusion of expensive and misplaced finery, which forms anything but ornament. Buildings of this class, which under skilful hands might have become proud monuments of public taste, are mortifying and repulsive objects to those who take an interest in the science of Architecture.

It has been too prevalent a habit, among those who would not think themselves capable of instructing a Carpenter in the art of planing or sawing boards, or a bricklayer in laying bricks, to undertake the much more difficult task of becoming their own Architects. The consequence is, that such persons proceed to build without any fixed system; unlooked for difficulties are soon encountered, which lead to expensive alterations, and the harmony of the building is destroyed. Nor is this evil confined to private buildings. The committees selected to superintend our public edifices are apt to cramp the invention of the Architect by their economy, or pervert it by their fancies; so that specimens of the taste of some member of the committee can usually be discerned by a skilful eye, among our most scientific compositions. But the evil is certainly decreasing. Knowledge of the science is rapidly gaining ground, and the increased attention attracted towards the subject disposes those who have not the necessary information to confide in those who have.

The principles and practice of the science are developed, in the following pages, in a detailed and systematic manner. The text is taken from the Grecian system, which is now universally adopted by the first professors of the art, both in Europe and America; and whose economical plan, and plain massive features, are peculiarly adapted to the republican habits of this country.

I have given examples of each of the five orders of Architecture; first in the usual way, then repeating their details upon a large scale. There are likewise added a Column and Entablature, selected from the Grecian antiquities, and standing, with regard to expense, between the Tuscan and Doric orders.

I have also given six examples of Frontispieces and Porticoes, with their details drawn on a large scale. To these are subjoined explanations and practical observations on their proportions and adaptation to the buildings in which they are to be used: also, a variety of examples of Cornices, for both external and internal finishings, and of Architraves and Base Mouldings, accurately drawn one half of the full size for practice, and accompanied with practical observations on their size and fitness; examples of Doors, Windows, and their decorations; Ornamental Mouldings, Stairs, and Carpentry; together with all the elements of Architecture which are necessary to supply the wants of the practical builder. To these are added a complete drawing of a Church, with all its details laid down in imitation of working drawings, with suitable explanations.

ASHER BENJAMIN.

Boston, March 19, 1833.

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ERRATA.—On page 78, line 14, for "first-mentioned" read "second-mentioned."
" " 17, for "second" read "first."
" " 20, for "first" read "second."
" " 21, for "latter" read "first."

I TRUST the following Tables will be found useful to those who are in the habit of making estimates on Iron Work. In my own practice, I have often felt the want of something of the kind. The fractions of an ounce I have given no further than the first decimal figure, supposing that would be accurate enough for our purpose.

A Table showing the Weight of a square foot of Cast and Malleable Iron, Copper, and Lead, from one sixteenth to one fourth of an inch thick.

	CAST IRON.		MALL. IRON.		COPPER.		LEAD.	
	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
One sixteenth of an inch thick	2	$6\frac{8}{10}$	2	$7\frac{6}{10}$	2	15	3	11
One eighth "	4	$13\frac{3}{10}$	4	$15\frac{6}{10}$	5	14	7	6
Three sixteenths "	7	4	7	$7\frac{4}{10}$	8	13	11	1
One fourth "	9	$10\frac{6}{10}$	9	$15\frac{2}{10}$	11	12	14	12

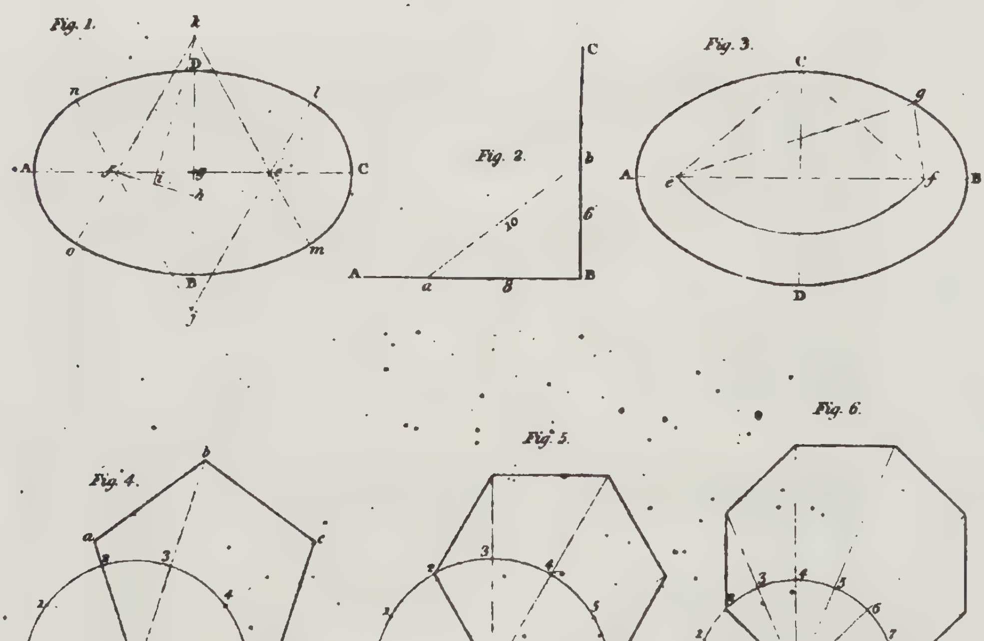
A Table showing the Weight of one foot in length of Cast and Malleable Iron, from one half to one and one half inch square; also of round Rods, from one half to one and a half inch in diameter.

	CAST IRON.	MALL. IRON.	ROUND RODS.
	oz.	oz.	oz.
One half of an inch	$12\frac{8}{10}$	$13\frac{8}{10}$	$10\frac{4}{10}$
Five eighths	"	$20\frac{1}{10}$	$16\frac{8}{10}$
Three fourths	29	$29\frac{8}{10}$	$23\frac{4}{10}$
Seven eighths		$40\frac{8}{10}$	$31\frac{8}{10}$
One inch	$51\frac{1}{2}$	$53\frac{1}{10}$	$41\frac{1}{2}$
One and one eighth of an inch		$67\frac{7}{10}$	$52\frac{4}{10}$
One and one quarter "	$80\frac{8}{10}$	83	$64\frac{8}{10}$
One and one half "	116	$119\frac{1}{2}$	$93\frac{3}{10}$

A Table showing the Weight of a cubic foot of several kinds of Timber, and other Materials.

	lbs.		lbs.		lbs.
Ash	$47\frac{4}{10}$	Coal, Newcastle	$79\frac{18}{100}$	Mahogany	35
Beech	$43\frac{3}{10}$	Earth	95 to 125	Marble	169
Brass	523	Elm	34	Oak	52
Brick	115	Granite	164	Pine, yellow	$26\frac{1}{2}$
Brickwork	117	Gravel	120	Sea Water	$62\frac{1}{2}$
Cast Iron	450	Iron, malleable	475	Water	62
Clay	125	Lead	709	Zinc	$439\frac{1}{2}$

PLATE I.



PRACTICE OF ARCHITECTURE.

PRACTICAL GEOMETRY.

PLATE I.

Fig. 1 shows a method of drawing an oval to any given length and breadth. Let A C be the larger, D B the smaller diameter, and *g* the centre of the oval. Deduct one half of the difference between A *g* and D *g* from D *g*, and with the remaining part of D *g* and from A and C mark the centres *f* and *e*. On *f* describe the arc *n* A *o;* and on *e*, the arc *l* C *m*. Make B *h* equal to A *f* or *e* C; join *f h*, and bisect *f h* at *i;* draw *i k* perpendicular to *f h*, intersecting B D at *k;* from *k* draw *k o*, cutting A C at *f*, and *k m*, cutting A C at *e;* make *g j* equal to *g k;* and from *j* draw *j f n* and *j e l*. Then on *k* and *j* as centres, with either of the distances *k o*, *k m*, *j l* or *j n*, as a radius, describe the arcs *o* B *m* and *n* D *l;* and the oval is completed.

Fig. 2 shows a method of making a right angle with a ten foot rod. Suppose A B and B C to be two sills to a building, and B one of its angles. Suppose it required to place them at right angles with each other. Measure off upon A B eight feet to *a*, and on B C six feet to *b;* then make the diagonal line *a b* exactly ten feet, and B A and B C will be at right angles with each other.

Fig. 3 shows a method of describing an ellipsis with a cord. Let A B be the transverse, and C D the conjugate diameter. With one half of the transverse diameter as a radius, and on C, describe an arc cutting A B at *e* and *f*. At these points fix in pins, a cord being placed around the pins and brought together at C; then move the cord round from C, towards *g*, and it will describe an ellipsis. This method of describing an ellipsis is exceedingly useful in laying out ground, where great accuracy is not required, and where large ellipses are to be described.

Figs. 4, 5 and 6, show a simple method of describing a polygon of any number of sides, one side being given. On the extreme of the given side, and with a distance equal to that side or to any other distance as a radius, describe a semicircle, and divide it into as many parts as you intend to have sides to your polygon. Then draw lines from the centre through these divisions, always omitting the two last, and with the distance of the given side run the sides round as in fig. 4. For example, *e d* being the given side, with that distance in your compasses, having one foot in *e*, let the other fall on *a*; then with one foot in *a*, let the other fall on *b*; and with one on *b*, let the other fall on *c*, and the same with *c* to *d*, and the sides are completed.

Fig. 7 shows the method of finding a straight line nearly equal to the circumference of a given circle. Let F D H E be the given circle. Draw D E, cutting the centre at G; and from G, perpendicular to D E, draw G F C. Divide G F into four equal parts, three of which parts set up from F to C; from C, draw C B, cutting the circle at D; and from C draw C A, cutting the circle at E. Draw B A parallel to D E, making a tangent with the lower extremity of the circle at H, and B A will be equal to one half of the circumference of the circle.

SECTIONS OF SOLIDS. PLATE II.

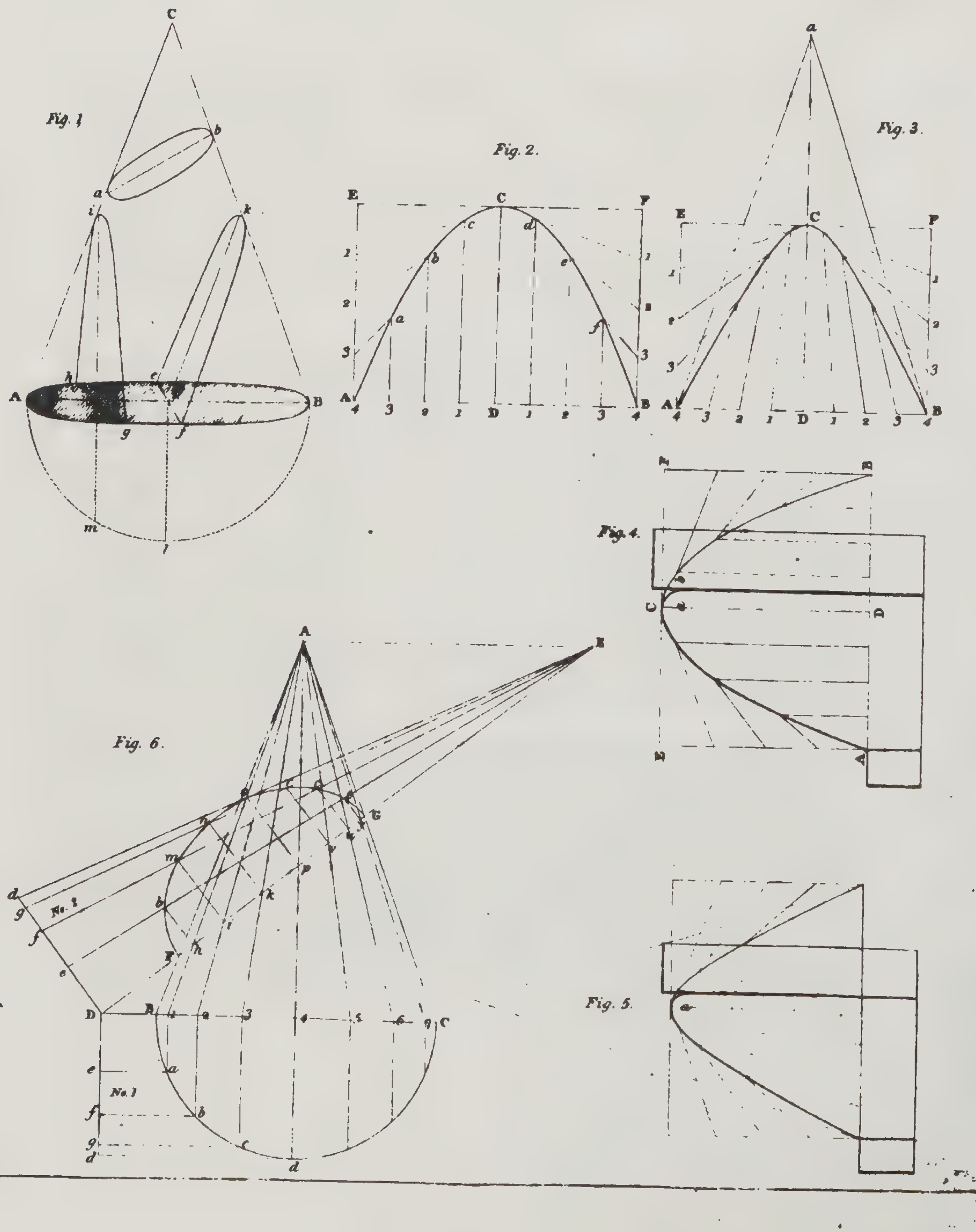


Fig. 8 shows the method of describing a segment of a circle to any given length and height. A B being the length, and E D the height, join respectively the points A B, A D, and A C, and draw D C parallel to A B, and equal to A D. Put in pins at A and D; and, with a point at the angle D, move the triangle A D C around, until the angle D arrives at A, and it will describe the segment A D. The other side of the segment may be drawn in a similar manner.

Fig. 9 shows another method of drawing a circle nearly accurate, by ordinates. Let A B be the length, and D C the perpendicular height. Make B *b* and A *a* each equal and parallel to D C. Divide D A, D B, B *b* and A *a*, each into a like number of equal parts, as here into four, and draw lines from the points 1, 2, 3 in D B and in D A parallel to D C. From C draw lines to the points 1, 2, 3 in both B *b* and A *a*; and through the points where those lines intersect the lines drawn from 1, 2, 3 in D B and D A, trace the curve, which will be the segment required.

CONIC SECTIONS.

PLATE II.

It is well known to those, who have a knowledge of Grecian architecture, that every Grecian moulding is indebted to some one of the conic sections for its beautiful variety of outline; and that that outline is regulated by the particular section made, whether it be perpendicular to the base, or more or less inclined to it, or parallel to the sides, or whether the sides of the cone be longer or shorter than the diameter of the base. It is therefore evident that an endless number of different outlines can be obtained from the conic

sections; which makes it expedient to lay down the cone with several of its sections, and to show the method of applying them to the Grecian moulding.

If a cone be cut by a line parallel to its base, such a section will be a circle.

If a line passes through the cone, intersecting both of its sides and inclining more or less to the base, as *a b*, a section thus made will form an ellipsis or oval.

If a section be made by a line perpendicular to the base, as *c i*, that section will be an hyperbola, as *h g i*.

If a section be made by a line passing parallel to one of its sides, as *d k*, the figure of the section thus made will be a parabola.

Fig. 1. On *d* as a centre, describe the half circle A *m l* B, which will be the semi-diameter of the cone's base. With a view to illustrate the subject, the lower extremity of the cone is thrown into perspective. Draw *d l*, perpendicular to A B. On fig. 2, make D A and D B each equal to D *l* fig. 1, and make D C equal to *d k* in fig. 1, and perpendicular to A B in fig. 2; draw A E and B F, each equal and parallel to D C; divide D A, D B, A E and B F each into a like number of equal parts; into four, for instance, as here. Through the points 1, 2, 3, in both A E and B F, draw lines to the point C; also, through the points 1, 2, 3, in D A and D B, draw lines parallel to D C, cutting the former ones at *a*, *b*, *c*, *d*, *e* and *f*. Then through those points, and the points A C and B, trace a curved line, which completes the section of the parabola.

Fig. 3 exhibits the method of drawing the hyperbola. Make D *a* equal to *d* C, the height of the cone fig. 1. Make D A and D B each equal to *c m* fig. 1, and perpendicular to D *a* fig. 2; make D C equal to *c i* fig. 1; make A F and B F each equal and parallel to D C; join respectively the points E F, A *a* and B *a*.

Divide D A, D B, A E and B F, each into a like number of equal parts; as here, into four. Through the points 1, 2, 3, in both A E and B E, draw lines to the point C; also through the points 1, 2, 3, in D A and D B, draw lines cutting the former ones, and which would, if produced, meet in a point at *a*. Then, through A, C, B, and the points of intersection, trace a curve line, which will be the hyperbola required.

Fig. 6 exhibits the method of drawing the section *a b*. On fig. 1, which is taken lower down the cone with a view of representing the lines more clearly, let A B C be the outline, and B *d* C the semi-diameter of the cone. Produce F G to E, there cutting A E, which is parallel to B C; also produce G F to D, cutting the base line at D. Divide the semi-diameter of the cone into eight parts, and through these divisions draw lines perpendicular to B C, and cutting B C at 1, 2, 3, 4, 5, 6 and 7; through these points draw lines meeting in a point at A. Draw *d* D perpendicular to D E, and equal to B 4; from *a, b, c* and *d*, draw lines parallel to D C, cutting D *d* at *e, f, g* and *d*; draw D *d* No. 2 perpendicular to G D, and equal to D *d* No. 1. Make D *e*, *e f*, *f g* and *g d*, in No. 2, each equal to the corresponding letters in No. 1; then draw lines from the point E, cutting D *d* No. 2 at *e, f, g* and *d*. From the points *h, i, k, p, v, u* and *y*, perpendicular to D E, draw lines cutting *e* E at *b t*, *f* E at *m c*, *g* E at *n r*, and *d* E at *o*. Through these points, and through F and G, trace the curve line F *b m n o r c t* G, which is one half of the section required.

As three different sections of the cone have now been described, and as the principal object of their description was to show their application to the Grecian mouldings, I now proceed to apply them to that object. The lines within A D B and E C F, in fig. 4, are in all respects similar, and like those within the corresponding letters fig. 2.

It will be seen, by inspection of fig. 4, that the outline of the echinus there described from A to C is exactly that of a parabola; and that from C to *b*, where the quirk joins the fillet, is another and shorter curve. In determining the size and outline of the quirk, and also the projection of the fillet beyond that of the extreme part of the moulding, judgment is to be exercised. If the quirk is very small, it does not mark the line of separation between the echinus and fillet sufficiently strong; and on the contrary, if it be too large, it then assumes too much the appearance of principal, when it ought to be subordinate.

As the hyperbola fig. 3 is transferred to fig. 5, it is evident that the outline of the moulding therein exhibited is that of the hyperbola, with the exception of the quirk, which is, as in fig. 4, of another and a shorter curve.

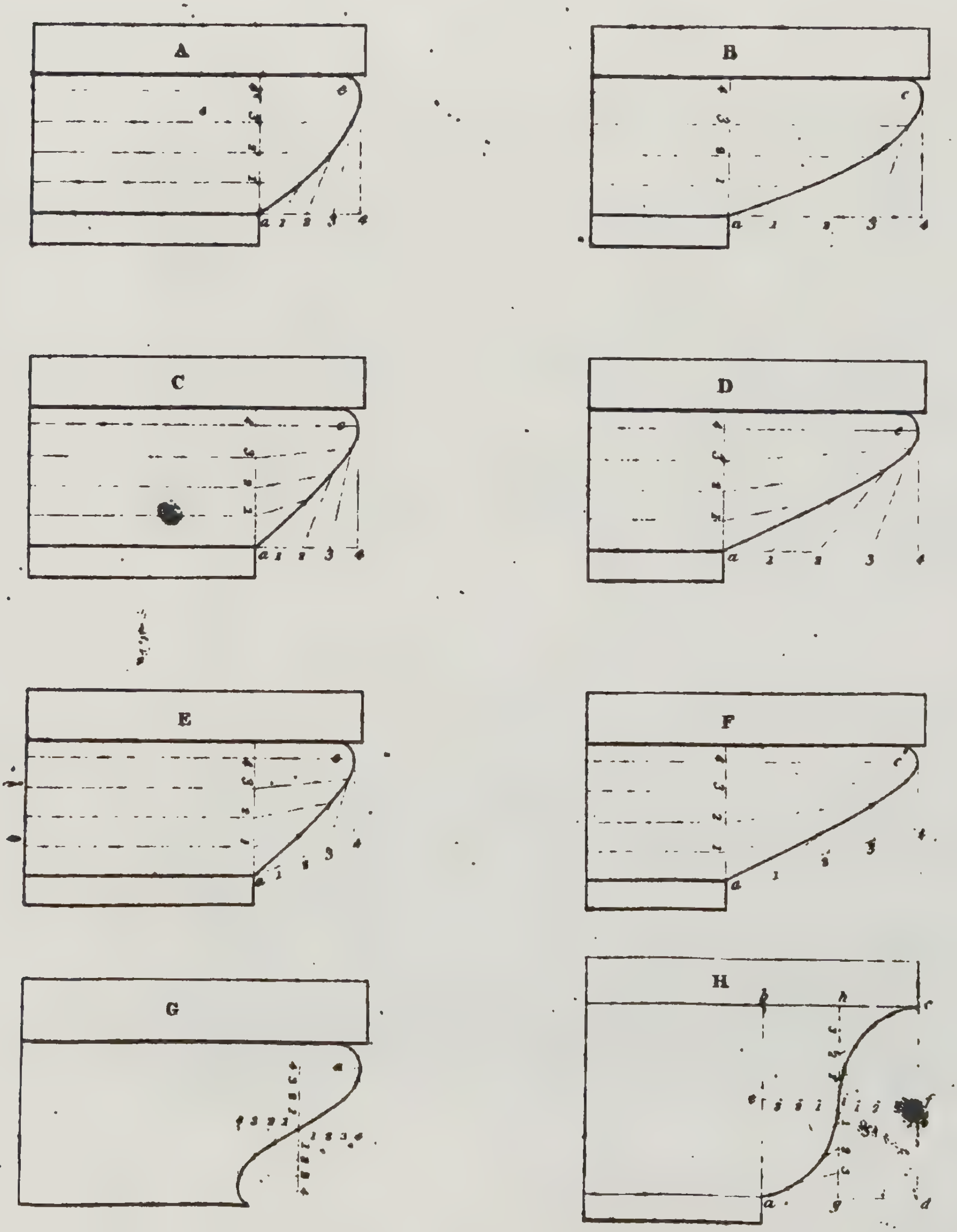
GRECIAN MOULDINGS.

PLATE III.

A and B are two mouldings differing in their projection only. It will be seen that the principle upon which they are drawn is that of the parabola, as exhibited in Plate 2, fig. 4. Let it be remembered that the projection of the moulding must be divided into the same number of equal parts as the height, be the difference in height and projection ever so great.

The principle of the two mouldings C and D is that of the hyperbola, as exhibited in fig. 3, Plate 2. The lines drawn from the divisions on the line of height would, if produced, meet in a point. In order to determine at what distance this point shall be from the

GRECIAN MOULDINGS. PLATE III.



extreme projection of the moulding, we must consider what shape the outline of the moulding is to assume. If it is to approach very nearly to a straight line, then the centre must not be very distant from the moulding; but should it be desired to have the outline of a shorter curve than C or D, then the centre must be farther removed from the extreme projection of the moulding.

The only difference between the drawing of the mouldings E and F, and that of the mouldings C and D, is that the line *a* 4 would, if produced, meet in the same point with those cutting *a* F at 1, 2, 3 and 4; whereas the lines *a* 4 in C and D are both parallel with the moulding. It is therefore apparent, that by this deviation the outline approaches somewhat nearer to a straight line, and that the upper extremity of the moulding is considerably reduced in height.

G exhibits a method of describing the cimatium on the principle of the parabola. It will be understood by examining the Plate, without further explanation. The turning in of the upper, and out of the lower edge, is left to the judgment of the student.

To draw the cima-recta H. Its projection *a d*, and its height *d c*, being given, bisect *a d* at *g*, and draw *g h* parallel to *a b*; bisect *a b* at *e*, and draw *e f*, cutting *g h* at *i*. Divide *i g*, *i h*, *i f*, and *i e*, each into a like number of equal parts, and from *b* draw lines cutting *i e* at 1, 2 and 3. From *a* draw lines passing through those last drawn, and cutting *i g* at 1, 2 and 3. Then trace the curve through the points of intersection of those lines, and it will finish the lower half of the moulding. The upper half, being drawn in the same way, will not require further explanation. By this method, the outline of the cima-recta may be correctly drawn, in imitation of the Grecian practice, to any height and projection. It is however to be remembered, that the projection should not in any case exceed the height.

The several different sections of the cone, with their application to the outline of the Grecian mouldings, have, I trust, been so fully explained, as to enable the student to comprehend how great a variety of outline may be obtained from them. When the principles, on which they are drawn, are fully understood, and the student has accustomed his eye to distinguish the peculiar outline of each different section, he may in practice, when the size and contour of a moulding is determined, cut a thin piece of wood by that same eye to the exact shape wanted, and by this mark the outline.

ROMAN MOULDINGS.

PLATE IV.

Of these mouldings but little need be said in relation to the principles on which they are drawn, the outline of each being some part of a circle.

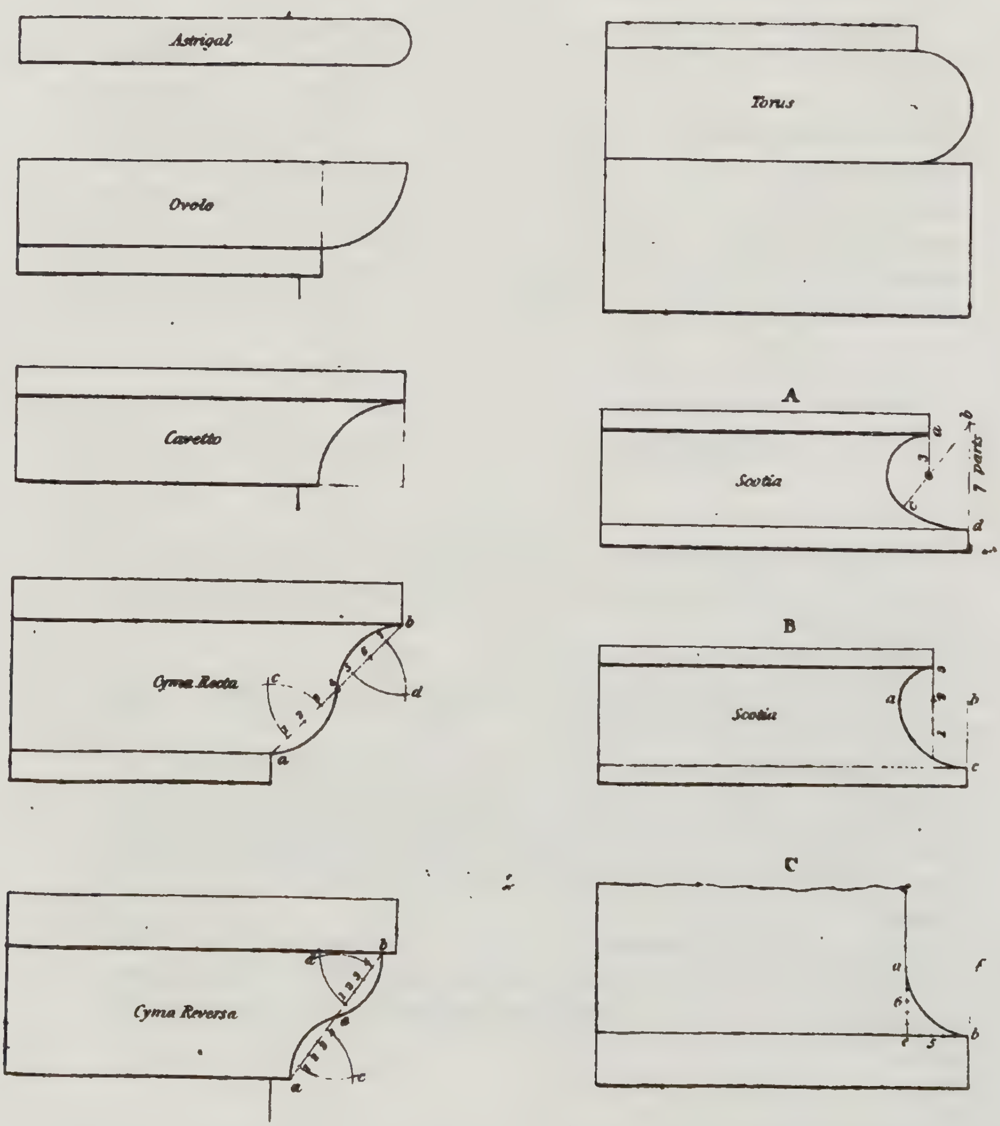
The astrigal, or bead, is one half of a circle.

The ovolo and cavetto are each one quarter of a circle. Their projection and height are equal.

To draw the cima-recta, divide the line *a b* into eight equal parts. With three of these parts as a radius, and on *a* and 4, make the intersection *c*; on *c*, describe *a* 4; on 4 and *b*, make the intersection *d*; on *d*, draw 4 *b*; which completes the outline of the cima-recta.

To draw the cima-reversa, divide *a b* into ten equal parts. With four of these as a radius, and on *a* and *e*, make the intersection; on *c* draw *a e*, on *e* and *b* make the intersection *d*, and on *d* draw *e b*.

ROMAN MOULDINGS. PLATE IV.



The torus is, like the bead, a half circle, which finishes with a fillet above and a plinth below.

To draw the scotia A, divide its height into seven equal parts, and make *a o* equal to three of them and perpendicular to the fillet. Make the fillet *d* project three parts beyond the fillet *a;* make *d b* parallel to *a o*, and equal to the height of the scotia. From *b*, cutting *a o* at *o*, draw *b c;* on *o*, with the distance *o a*, describe the curve *a c*, and on *b*, with the distance *b c*, or *b d*, describe *c d*.

To draw the scotia B, divide its height into three equal parts. Project the fillet *c* one part more than the fillet 3. On 2, with the distance 2, 3, describe the quadrant 3 *a;* with *b c* or *b a*, and on *b*, describe the quadrant *a c*.

To draw the scape of a column, divide its projection into five parts. With these five parts, and one more as a radius, from *a* and *b* make the intersection *c*, and on *c* describe the scape *a b*.

MOULDINGS AND THEIR APPENDAGES.

MOULDINGS, judiciously intermixed with plain surfaces, such as fillets, facies, coronas, &c., are the elements to which architecture is indebted for its most splendid productions. It is on the size, shape and fitness of these details, together with that of the plain surfaces which serve to divide and enrich them, that the beauty or deformity of every production, composed of these elements, depends.

Any one, who is desirous of making himself a judge of these details, must study the outline separately and critically, when affected by shadow, and when by reflecting light. After he has accustomed his eye to discern and retain the beauties and fitness of each for

all the different situations in which he may wish to employ them, he will then as faithfully study the size, shape and fitness of all plain surfaces by which the mouldings may be separated and adorned. After this, he must study them collectively, by frequently drawing and intermixing their details; and he will thus be able to discern the good and bad effects of his composition, and improve his taste. Every composition is not only dependent upon the outline of its details; but upon the proportion which the size of one bears to that of another and to the whole, and upon its adaptation to its intended place.

REMARKS ON MOULDINGS.

THE ovolo, when used as a crown moulding, was generally made by the Greeks to project about three-fourths of its height, and to project to a distance about equal to its height, when used in the capital of the Doric column. The great variety of outline, and the strong shadow produced by the quirk of its upper edge, render this moulding, when possessing the Grecian form, equally applicable to a large or small projection; so that it can be used in a great variety of situations, with nearly equal success. It is peculiarly adapted to flat surfaces; such as architraves, doors, panels, &c. It is different, however, with the Roman ovolo, whose projection cannot with propriety be made much greater or less than its height; for should it project much more, or much less, the outline would then become less than a quarter of a circle, which defect limits the application of this moulding, compared with that of the Grecian, to a very few situations.

The cavetto, in its outline, did not differ very essentially in the Greek and Roman practice. It was employed often, by the Romans, as a crowning moulding in their cornices, but never by the Greeks. Its outline may often be improved by adopting some part of the ellipsis for its curve.

The cymatium, as practised by the Greeks, was generally less in projection than in height. Its outline was always some part of a conic section; so that it appeared equally beautiful, whether the projection was great or small. When the moulding is very flat, it is well to cause the lower edge to project forwards and the upper edge to recede. The light and shadow are thus so distributed over the surface of the moulding, as to cause a marked line of separation from the adjoining flat surfaces.

The cymatium, as practised by the Romans, was generally composed of parts of a circle, the outline of which at the two extremities of the moulding ended perpendicularly to the horizon. The light and shadow were therefore very faint at the edges, and its variation from a flat surface hardly distinguishable. The cymatium was generally employed by the Romans to separate the crown moulding from the corona, in the Ionic, Corinthian, and Composite orders, but seldom or never used for that purpose by the Greeks.

The cima-recta was always the finishing, or crown moulding of the Ionic and Corinthian orders, as practised by the Grecians. It had a great height and small projection in the best examples. Its outline was made to imitate some one of the conic sections, and produced a shadow less abrupt and hard than the Roman, which was always composed of parts of a circle.

THE ORDERS OF ARCHITECTURE.

Each of these orders presents a distinct style or mode of building, having a character peculiar to itself. The orders are the alphabet of the art; and to them and their elements, altered, varied and arranged in a thousand different ways, we are to look for the most splendid productions of architecture. A thorough knowledge of these orders, and of all their constituent parts, is therefore necessary for the composition of any architectural subject.

Of these orders, the Doric, Ionic, and Corinthian, are of Grecian origin. They exhibit three distinct and essential qualities in architecture; strength, grace, and richness.

The Tuscan and Composite orders are of Roman origin. The former appears to have been invented for the purpose of exhibiting strength and rustic simplicity, while elegance and profusion appear to have been the object of the latter.

By whom these orders were first invented, or at what time their improvement was advanced to the state in which they are to be found in the structures and fragments of antiquity, cannot now be ascertained. We know nothing of their origin except what is related to us by Vitruvius, a writer whose correctness in many parts is much questioned. He is the only author upon Architecture of the Augustan age, or for many ages afterward, whose works have come down to us. His writings are justly held in great estimation. It must be confessed, however, that his account of the origin of the orders has more the air of a fable than of an historical fact. Vitruvius informs us that "Dorus, the son of Helen, and the nymph Opticus, who governed Achaia and the whole of the Peloponnesus, in some period of his reign, dedicated a temple to Juno

in the ancient city of Argos. The order of architecture employed in this sacred edifice, which from its founder was termed Doric, was afterward adopted by the cities of Achaia; although no certain principles had been yet established by which its proportions might be regulated. In a subsequent era, the Athenians, in conformity with the response of the Delphic oracle, by the general consent of the States of Greece, sent thirteen colonies into Asia, each conducted by an experienced leader, and invested Ion, son of Xuthus and Creusa, whom Apollo by his priestess acknowledged as his offspring, with the supreme command. He led them into Asia, and possessed himself of the territories of the Carians, in which he founded the cities of Ephesus, Miletus and Myus; the latter of which being destroyed by an inundation, its rites and privileges were transferred by the Ionians to the Milesians, likewise Priene, Samos, Yeos, Colaphon, Chios, Erythræ, Phocæa, Clazomenæ, Lebedus and Melite. The last was destroyed in the war, which was undertaken by the general concurrence of the other cities to punish the arrogance of its inhabitants; and in its place Smyrna was afterwards admitted among the confederated States, through the mediation of Attalus and Arsinoe.

"After the expulsion of the Carians and the Leleges, the new acquisition was called Ionia, from the name of the chief of the colonists; and temples were erected to the deities of the Grecian mythology, the order of architecture of which was similar to that observed in the sacred buildings of Achaia, and called the Doric, from having originated in the Dorian cities. The Temple of Apollo Panionius was the first they constructed in this manner. Desirous of adorning this temple with columns, but unpracticed in the rules of proportion, they were led to consider the proportions of the human frame; expecting principles to result from them, by the adoption of

which the great objects of strength and beauty would be obtained. Finding that the foot was a sixth part of the height of the whole stature, they instituted the same proportions in their columns, whose height, including the capital, they made equal to six times the diameter of the shaft at the base. Thus the Doric column, formed according to the proportions of the human figure, and emblematical of manly strength and beauty, was first introduced in the temples of Ionia. In later times, however, when it was in contemplation to consecrate a temple to Diana, they sought to introduce a new order of columns by giving to them the proportions of the female form; and that they might be emblematical of feminine delicacy, the height of the columns was made eight times the lower diameter. Bases were also given to them in imitation of sandals, and volutes were sculptured in allusion to the ringlets which fell down on either side of the face. The cymatia and encarpi in front were intended to resemble the hair as it was then worn, and the shaft was channelled in such a manner as to bear some resemblance to the folds of the matronly garment.

"Thus the invention of two different orders arose; one exhibiting the boldness and simplicity of the masculine figure, and the other the more finished form of a woman, attired and richly decorated. Later ages, however, advancing in refinement and judgment, sought to give greater beauties to both by making the Doric column seven times its diameter at the base of the shaft, and the Ionic nine times its lower diameter. The order, whose use was adopted first by the Ionian colonies, was called the Ionic.

"The third order, which is named Corinthian, derives its symmetry from an intention to make the form of the column accord with the more delicate proportions of the maiden figure; for at that early period of life, the limbs are less robust, and the figure admits

of a greater display of ornament. The invention of the capital is said to owe its origin to the following circumstance. A virgin of Corinth, just as she had attained to a marriageable age, was attacked by a disorder whose effects proved fatal. After her interment, the vases, the objects of her admiration when alive, were collected by her nurse and deposited in a basket, which she placed upon her grave, after covering it with a tile to protect it from the weather. The basket was accidentally placed over the roots of an acanthus. The natural growth of the plant being impeded by the pressure upon it, the middle leaf and the cauliculi appeared in the spring around the bottom of the basket. The cauliculi, attaching themselves to the external surface, grew upwards, until their progress was arrested by the angles of the tile projecting over the basket, which caused them to incline forward and assume a spiral form. At this stage of its growth, Callimachus, who, from his great genius and talent for sculpture, was called Catatechnos by the Athenians, chancing to pass by the spot observed the basket and the beauty of the young foliage around it. Pleased with its novel and fanciful appearance, he adopted it in the columns which he afterwards employed in the edifices of Corinth; having first instituted laws for the proportions of the order, which was thence termed Corinthian."

An order of architecture consists of one or more columns, standing perpendicularly to the horizon, and supporting an entablature, which extends from column to column.

Each order is composed of two principal divisions, the column and the entablature; which are respectively subdivided into three parts: the column, into the base, the capital and the shaft; and the entablature, into the architrave, the frieze and the cornice.

The base is the lowest extremity of the column. It is generally

thirty minutes in height, and consists of a plinth, whose base line forms a square of four equal sides, projecting on each side of the column about ten minutes, above which is a series of mouldings, projecting equally all around, and encircling the shaft of the column.

The shaft of a column is in shape a frustum of a cone. It is that plain or fluted part, which is situated between the base and the capital. In some examples it is plain, in others fluted; and is differently formed and variously divided in the different orders. The diameter of the lower surface of the shaft is taken as the unit of measure. It is divided into sixty equal parts, each part being one minute. This scale of diameter and minutes is used by architects as an universal standard for all the measures that regulate and determine the heights and projections. Unlike the measure of feet and inches, it is as various as the diameter of columns.

The capital is the member which crowns and adorns the upper extremity of the column, and is usually made the characteristic of the order. It is both ornamental and useful; for, while it decorates the upper end of the column, it serves to prevent the angle from fracture and the rain from penetrating the shaft. Capitals are classified according to the order they serve to adorn. The Tuscan capital is distinguished by rustic plainness; the Doric, by grave simplicity; the Ionic, by graceful elegance; and the Corinthian and Composite, by gorgeous richness.

The architrave is the lowest division of the entablature. It is divided into one or more fascia, according to the character of the order to which it belongs, and crowned with a single or compound moulding. The Doric architrave differs from all the others, having only one fascia, which is capped with a band of rectangular form, and ornamented with six conical drops hanging from the lower extremity of each triglyph.

The frieze is that part of the entablature which divides the architrave from the cornice. In the Tuscan order, it is always left plain, the frieze of that order not admitting of any ornament whatever. The Doric frieze is peculiar. It is ornamented with triglyphs, and the metopes are sometimes embellished with ox skulls or historical representations. The Doric frieze is also, to common observers, the distinguishing part of the order. In other orders the frieze is sometimes ornamented, but oftener plain.

The cornice is an assemblage of mouldings, crowning and finishing the entablature. Each order has a peculiar cornice. Every cornice is composed of three parts ; the bed mould, the corona, and the crowning moulding. The details of the Tuscan cornice are few, bold and strongly marked ; of the Doric, massive and simple, the mutule being a distinguished feature in that order. The elements of the Ionic cornice are more numerous than those of the Tuscan or Doric. The dentil, which properly belongs to it, is sometimes omitted for the modillion. At other times, the dentil and modillion are both left out, and a plain bed mould used in their stead.

The Corinthian and Composite cornices are embellished with both dentils and modillions, and are often otherwise decorated with a profusion of elegant ornaments.

The Tuscan order consists of a few prominent parts. Its character is simple grandeur, impressing the beholder at first sight with the conviction that its strength is adequate to the support of any weight it may be employed to sustain. It may be used in all situations, where strength and simplicity is desired, or expense is to be avoided.

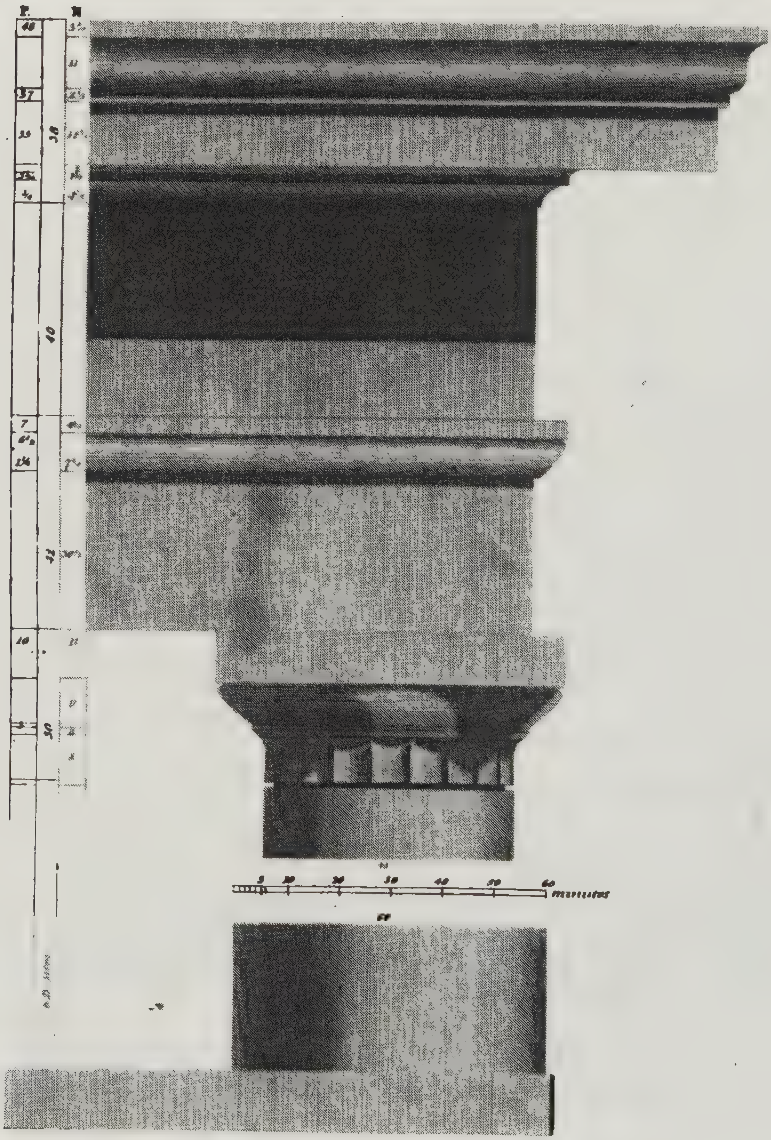
Of the Doric order we have numerous ancient examples now in existence, many of which have been accurately measured. It is

flowers, foliage and volutes with which it is adorned, seemed well adapted to the delicacy of such deities. Being the most splendid of the five orders, it is also extremely proper for the decorations of palaces, public squares, or galleries, and arcades surrounding them; for churches dedicated to the Virgin Mary, or to the Virgin Saints; and, on account of its rich, gay and graceful appearance, it may with singular propriety be used in theatres, in banqueting, and in all places consecrated to festive mirth or convivial recreations."

The Roman Composite order. Many fine examples of this order have been discovered in its native city, Rome, where it was held in greater estimation than it has ever been elsewhere. It was generally employed in their triumphal arches. The elements are nearly all borrowed from the Ionic and Corinthian orders. The base, the shaft, and the lower part of the capital, are Corinthian; the upper part, Ionic; the architrave, often a mixture of the Ionic and the Corinthian. The frieze is splendidly ornamented. The cornice is mostly Corinthian. The modillion is peculiar to this order, and has never to my knowledge been used in any other. It is composed of a large block, enclosed on three sides by two fascia and a crowning moulding.

Some writers on architecture deny this composition the rank and name of an order; and indeed the objection is made with more propriety than a similar one against the Tuscan order. I do not see, however, that we gain any particular advantage by depriving this ancient composition of a name and rank which it has held for many centuries. This, in fact, is with us the only honor paid it, as we seldom or never employ it in any of our structures.

TUSCAN ORDER.



THE TUSCAN ORDER.

PLATE V.

The Tuscan order is said to have been invented by the inhabitants of Tuscany; before the Romans had any intercourse with the Greeks, or had become acquainted with their arts and sciences. It is to be lamented that no regular example of this order has been discovered among the remains of antiquity. An example of Vitruvius, with his explanation, is the only source from whence we can derive information upon this subject; and this, taken as a whole, is not worthy of our imitation. It may be divided into two distinct parts, the good and the bad, or the column and the entablature. The column is the good part, and has been pretty generally imitated by all the modern architects; the entablature is the bad part, and has been as generally rejected. Some architects indeed have pretended to admire the entablature; but they have shown more wisdom in practice, by rejecting it in most of their structures. The cornice projects one fourth of the entire height of the column, and has neither bed-mould nor corona. It consists of a cima-recta and its two fillets, and is apparently supported by a few straggling, disproportionate canti-leaves, with the cimatium of the corona wrought across the end of each, and placed so as to form the Ionic crown moulding against each of the canti-leaves, and the Tuscan crown mouldings between them. Trajan's column, at Rome, is thought by some to be of this order. This column is nearly eight diameters in height, having a base nearly a copy of that left us by Vitruvius; but its capital and its general proportions partake strongly of the Roman Doric character.

Some architects are unwilling to allow this column and entablature the honor of being ranked as one of the orders of architecture. Say they, "It is nothing more than the Doric deprived of the mutules and triglyphs, and a diameter or two added to the height of the column." I cannot perceive the justness of these remarks. If any one of the orders is to be altered into the Tuscan, the Ionic* would certainly be more suitable for that purpose than the Doric. Change its capital and base for those of the Tuscan, leave off the flutings on the shaft of the column, and deprive it of a diameter or two in height, and the change is complete.

In the examples of this order, as here exhibited, the column is seven diameters in height, including the capital. This seems to have been the universal standard of its height, from the time of Vitruvius down to the present. Nevertheless, during a long course of practice, it is probable that in half of the instances, where I have had occasion to draw either of the orders, I have found the established proportions ill suited to my purpose. Many circumstances render different proportions both proper and necessary. The proportions in fact depend upon the judgment. He who takes the most comprehensive view of all the circumstances of the case, and governs his judgment by the simple and undeviating rule of proportioning the means to the end, will generally be the most successful.

Take the case of a venetian entrance recessed into a dwelling-house, embellished by two columns, and two antæ, their front line corresponding to that of the front of the building. The whole front above and directly over the entablature apparently depends on the two columns for support. Under such circumstances, any one who should fail to make a column nearly or quite a diameter less in

* As found on the Ionic Temple on the River Illissus.

height, than he would if the columns projected and were completely insulated from the front line of the building and had nothing but their entablatures to support, would soon be convinced of the error in his judgment. When columns are to be erected, consider for what end they are to be made: if for the support of any great weight, then make them of a size sufficient to answer that end; if for ornament merely, and not for the support of any great burden, construct them accordingly.

The example here exhibited does not differ essentially, in its general proportions, from that left as by Palladio, its column being seven, and its entablature two diameters in height. There is a difference however in the details, between this and Palladio's, and most or all of the other examples. The character of the Grecian Doric has been imitated in several particulars. First, by leaving off the base; and in the capital, the echinus and the channel which divides the capital from the column. The necking is fluted in imitation of that in Trajan's column at Rome. The architrave has only one fascia, the crowning moulding of which is in Grecian style. The cornice is divided into three parts; the bed-mould, the corona, and the crowning moulding.

The bed-mould is recessed up into the corona, so as almost to conceal the ovolo. This allows all the parts of the cornice to be somewhat enlarged and more strongly marked; which gives them more of that robust simplicity of character, which is peculiar to this order. The corona and crown moulding of this example are somewhat increased in altitude, compared with those of Palladio. The projection of the cima-recta is less than his, its outline forming a part of an ellipsis. The column diminishes twelve minutes. The diminution may begin at one fourth from its base, and the outline of its sides be curved, as practised by the Romans; or, which is

believed to be preferable, the diminution may begin at its base, in the Grecian style, and the outline of its sides be straight or gently curved outwards.

To draw this order to any given height, divide the height given into nine equal parts, and give one to the diameter of the column just above its base. Suppose a height of fifteen feet be required. Divide fifteen feet into nine equal parts. One of the parts must be one foot eight inches: this is the diameter of the column. Then divide one foot eight inches into sixty equal parts, which are called minutes. In practice this is easily done, by dividing one foot eight inches into six equal parts, each of which will of course be ten minutes, and then dividing each sixth into ten equal parts, one of which will be one minute. By this scale all the members of the order are to be proportioned, either in height or projection, each member being so many minutes of the scale, as is figured on the plate.

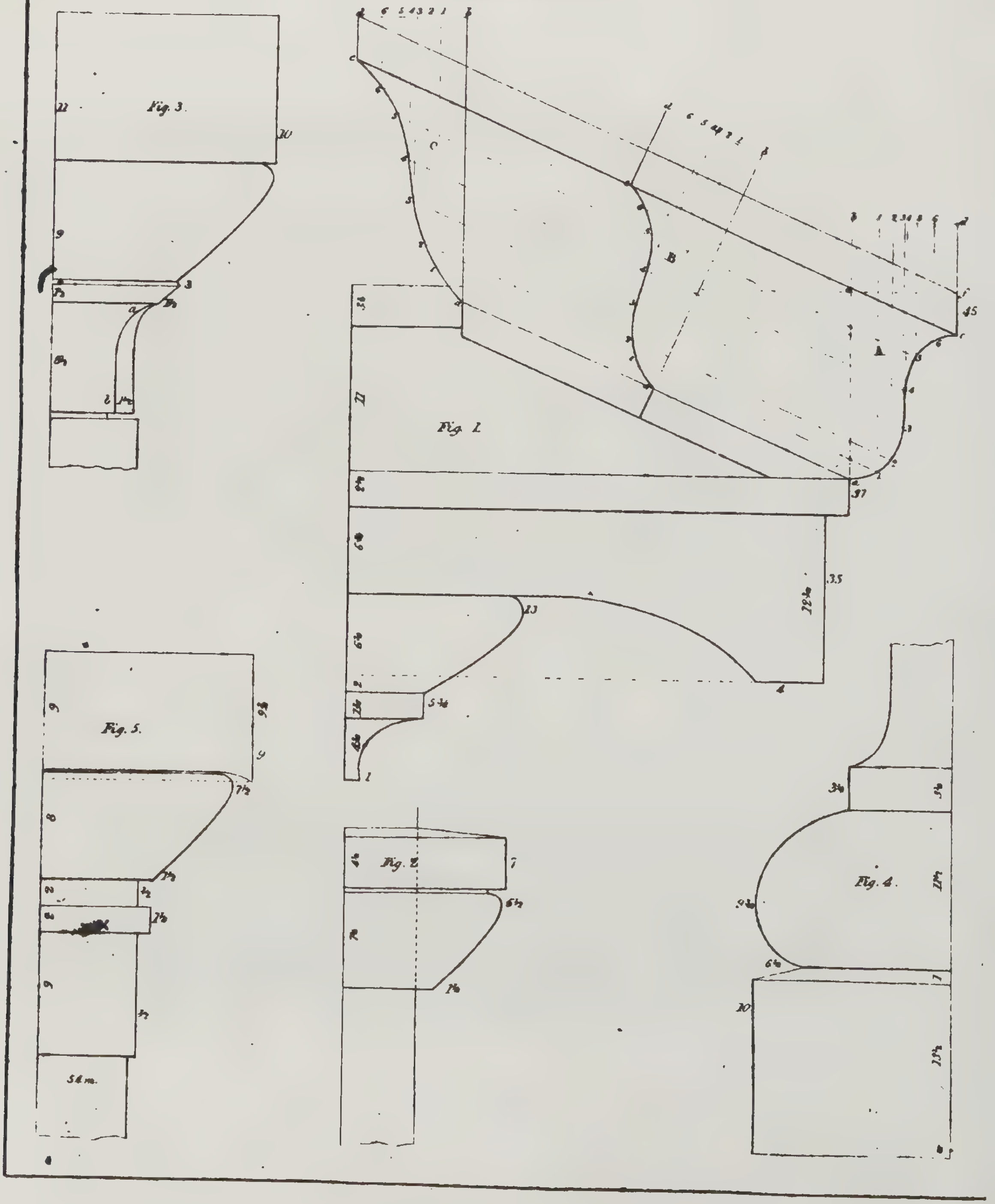
The directions here given for making a scale of minutes will serve for all the remaining orders.

DETAILS OF THE TUSCAN ORDER.

PLATE VI.

The outlines of which the mouldings of the Tuscan order are composed, are exhibited on a large scale. These outlines are in the true Grecian style. It will, therefore, be very important to the student to examine the particular shape and character of each diligently and carefully, and to imitate them exactly in his practice, be they enlarged or diminished. For he must remember, that the beauty or deformity of every composition of this kind depends mostly

TUSCAN ORDER. Pl. 6.



trave. Fig. 3 shows those of the capital. The necking of the latter is decorated with twenty flutes, in exact imitation of Doric flutes; to the directions for fluting which, the reader is referred for a knowledge of forming these. The line $a\ b$ shows the depth and termination of the flute under the annulet of the capital.

Fig. 4 shows an example of a base suitably constructed for this column, if one is to be employed; though it is believed that the column will generally succeed best without it.

Fig. 5 exhibits a capital for a pilaster, having the breadth of the pilaster figured upon it.

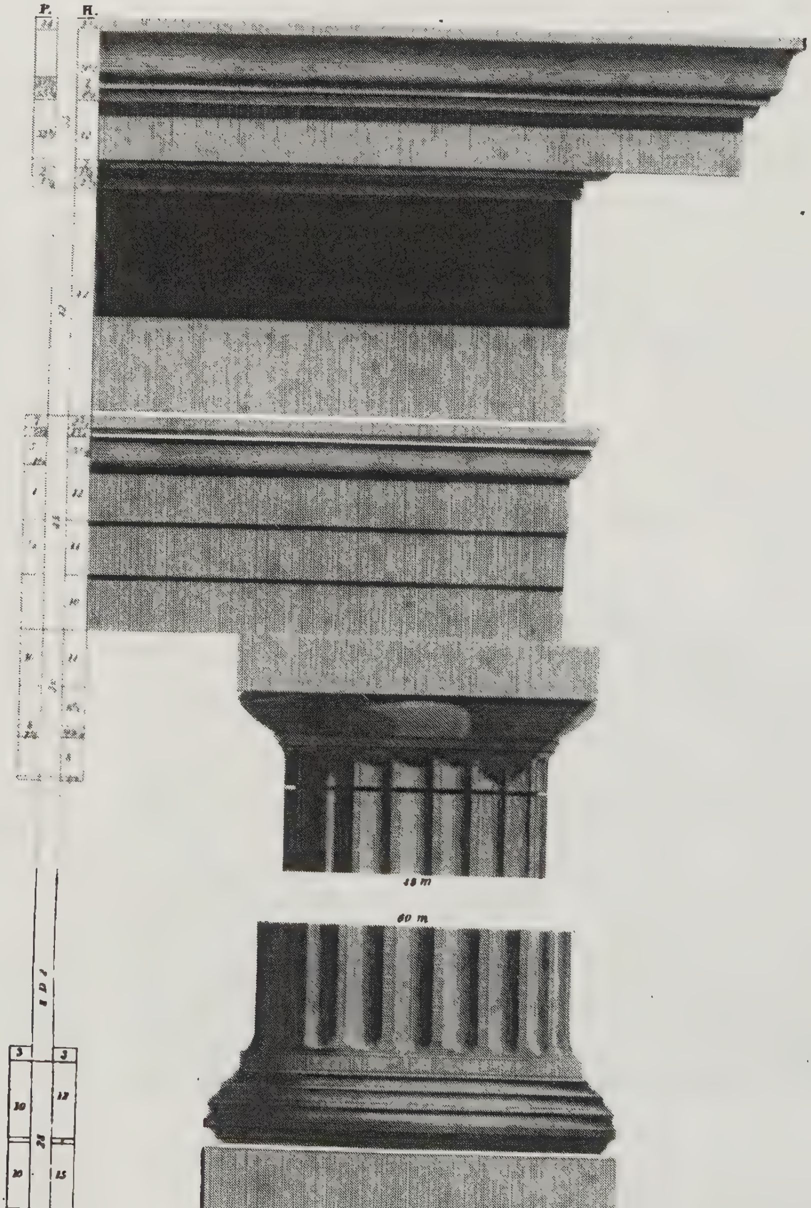
COLUMN AND ENTABLATURE.

PLATE VII.

I AM aware that the publication of anything in the shape of an order, unless it be really one of the Grecian or Roman orders, is, by persons well versed in architecture, thought to be little less than heresy. Although I am not much disposed to differ with them in their opinion, I have deemed it advisable in this case to depart from it. My reasons for so doing proceed from the fact, that more than one half of all the columns and entablatures erected in country situations, for either internal or external finishings, belong neither to the Grecian nor Roman system. The same fact holds true in relation to our cities and large towns. Any person who will take the trouble to compute the number of instances, in which some one of the regular orders is employed in any street of our cities, or villages, will be convinced of the truth of this assertion. I have made the comparison in two streets, which present more buildings of the first

COLUMN AND ENTABLATURE.

PLATE VII



class, in proportion to their number, than any other streets of their length in this city, and have found the regular orders employed in only thirteen places, while other columns and entablatures were substituted in twenty-three places.

I have often inquired the reason of this, from very intelligent workmen, and have as often received for answer, that the Tuscan order is too massive and plain, the Doric too expensive, and the Ionic too rich, and that they are therefore under the necessity of composing a column and entablature which will conform to the views and purses of their employers.

With these facts before me, no doubts rest in my mind but what it would be better to give a design here of a column and entablature, constructed on scientific principles, and of a character capable of meeting the views and practice above mentioned, than to leave it to be composed by unskilful hands.

In the composition here exhibited, the shaft of the column, together with its flutes and fillets, are in imitation of that found in the interior of the Temple of Apollo at Bassæ. This column was crowned with a very singular Ionic capital, of an angular form. Its base was also singular in its composition. Neither of them, however, were deficient in beauty. The shaft has here been adopted on account of its novel, graceful and simple aspect. The flutes in their section are in exact imitation of the best Grecian Doric flutes, but differ from any of the Doric examples by being separated by very small fillets, which are in breadth equal to one fifth or sixth of the breadth of the flute. The flutes are twenty in number, and descend and terminate on the scape of the column, in an elliptical form, like their section. They also terminate at their upper extremity on the scape in the same manner. All the details of the flutes and fillets, and also those of the whole composition, are very accu-

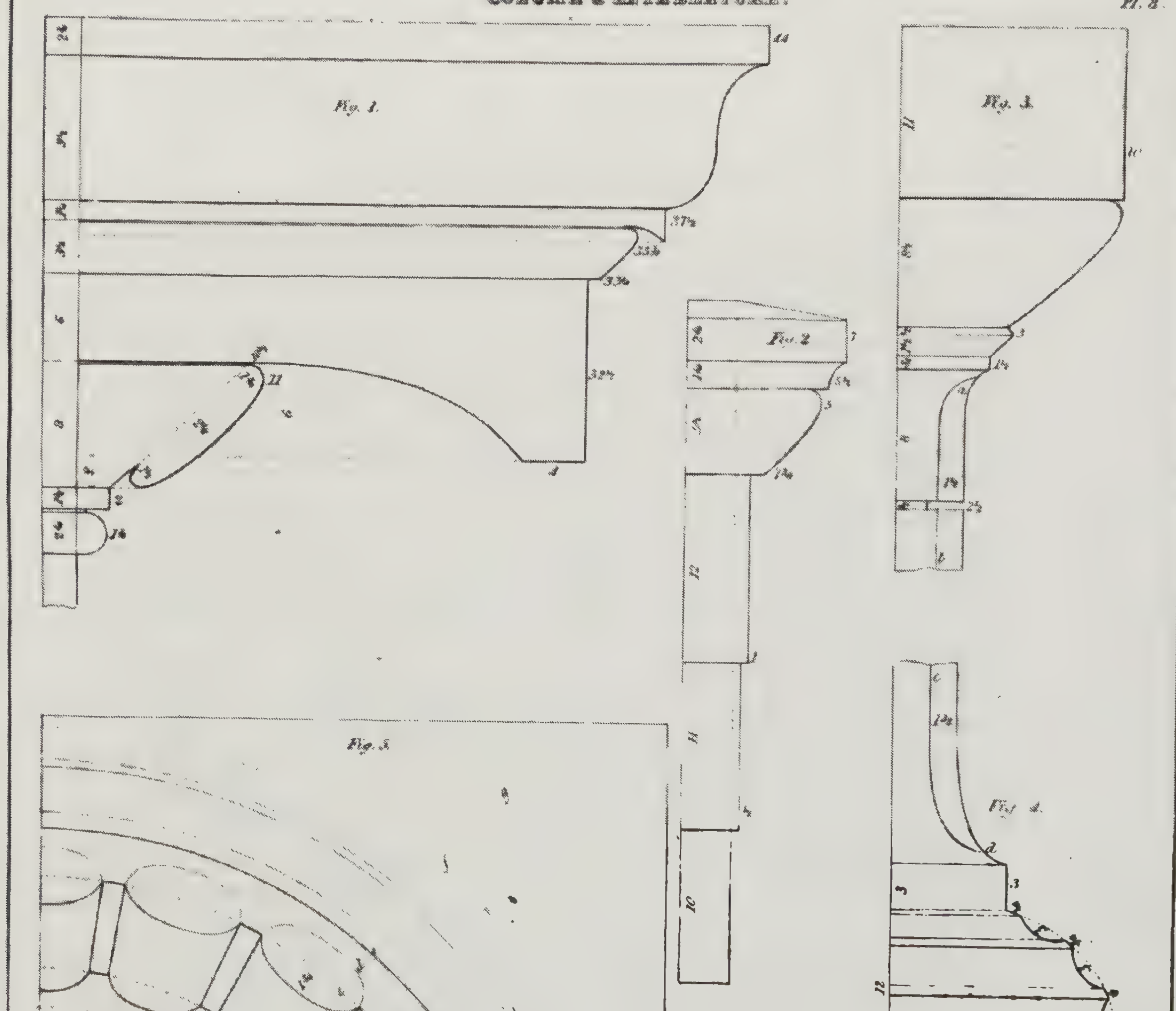
rately drawn on a large scale and figured in minutes. Great care has been taken to give to the outline of all the mouldings the true Grecian character.

The base is in its general form somewhat like that given by Vitruvius in his Tuscan order ; but the torus is elliptical, and fluted, in imitation of some of the best Grecian examples of the Ionic base. The base is not therefore either Tuscan or Ionic, but it stands in equipoise between the two.

The capital is imitated from that found on the newly discovered temple at Cadachio, in the island of Corfu. In its annulets, it partakes of both the Grecian and Roman schools ; but in the remaining details it is purely Grecian, and a beautiful specimen of their system.

The entablature is two diameters in height, and is divided into three parts: the architrave, the frieze, and the cornice ; the details of which have been selected with a view to economy and an adaptation to the column and to modern practice. In the cornice, the corona has a great projection and height ; the crown moulding has also a great height, but a small projection. The bed-mould is somewhat singular in its form, and about one half its altitude is recessed up into the plancer of the corona, which allows the members of the cornice to be somewhat enlarged. With one single exception, each moulding of this composition is indebted to some one of the conic sections for its beautiful variety of outline. As the selection and arrangement of the elements, which compose this column and entablature, have been the cause of much research and great solicitude, I hope that, when it shall be decided not to employ either of the regular orders, this composition may be found worthy of being made a substitute.

It is supposed that the larger and better class of edifices will



always be decorated with some one of the orders, as the proprietor will be amply compensated for the difference in expense, by the chaste and classic appearance of his building. It is to be expected, therefore, that this design will be used only on the smaller and cheaper class of buildings; in which case it will seldom be required to make the column larger than the Ionic proportions, say nine diameters.

If this example is to be used for a portico, where the house is of small dimensions, the windows and door likewise being of a small size, it will be most proper to make the column, at least, nine diameters in height. On the contrary, if the house be of a large size, as also the doors and windows, it will be advisable to make the column about eight diameters in height.

PLATE VIII.

On this plate are exhibited, on a large scale, the details of the Column and Entablature of the preceding plate.

Fig. 1 represents the cornice, with its members figured in minutes. It must be remembered, that those mouldings, which are recessed up under the member next above them, show here their whole height, and they are figured accordingly. But in the preceding plate, that part only is figured which is seen in a direct front view.

Fig. 2 exhibits the outline of the architrave; fig. 3, that of the capital; and fig. 4, of the base. The lines *d c*, on the shaft of the column near the base, and also *b a*, on the neck of the column, represent the depth of the flute, and its termination at each end.

Fig. 5 exhibits the plan of the plinth and base of the column. The line *f* shows the extreme outline of the base moulding; *e*, the outline of the fillet, which joins the scape; *c*, the line encircling the lower diameter of the column; *b*, the upper diameter; and *a*, the

depth of the channel which separates the capital from the shaft of the column.

In order to flute the shaft of this column, first divide its periphery into twenty equal parts, and subdivide one of those into six equal parts. Make each flute equal to five, and each fillet to one of these parts. Make the section of the flute elliptical and in imitation of this example, which is one and three fourths of a minute in depth at the lower diameter, and one and one half minutes at the upper diameter. The lines, at the letter *d*, exhibit the termination of the flute on the scape.

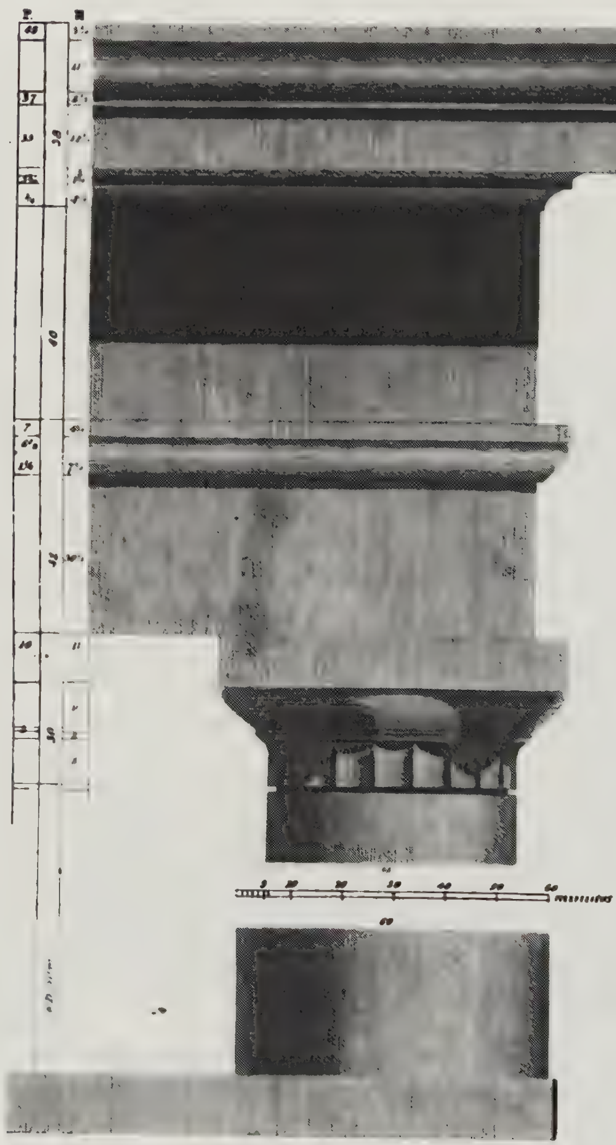
THE DORIC ORDER.

PLATE IX.

In the early practice of the Doric order, by the Greeks, the altitude of the column was usually about four diameters ; but in later times, this altitude was increased to six, or six and one half diameters. Most or all of the details of the order experienced, in like manner, a change. It does not appear that any two, of even the best specimens, and those too which were erected at the same period, agree either in their general or their particular parts.

But nowhere are to be found omitted, the twenty flat flutes without intervening fillets, the triglyphs in the frieze and the mutules in the cornice, with all their appendages. These formed the distinguishing features of the order. Their distribution has always been uniform. No deviation whatever was allowed. It was by the undeviating arrangements of these elements that Grecian architects were enabled, notwithstanding the latitude used in other less impor-

TUSCAN ORDER. PLATE V.



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DETAILS OF THE TUSCAN ORDER.

PLATE VI.

The outlines of which the mouldings of the Tuscan order are composed, are exhibited on a large scale. These outlines are in the true Grecian style. It will, therefore, be very important to the student to examine the particular shape and character of each diligently and carefully, and to imitate them exactly in his practice, be they enlarged or diminished. For he must remember, that the beauty or deformity of every composition of this kind depends mostly

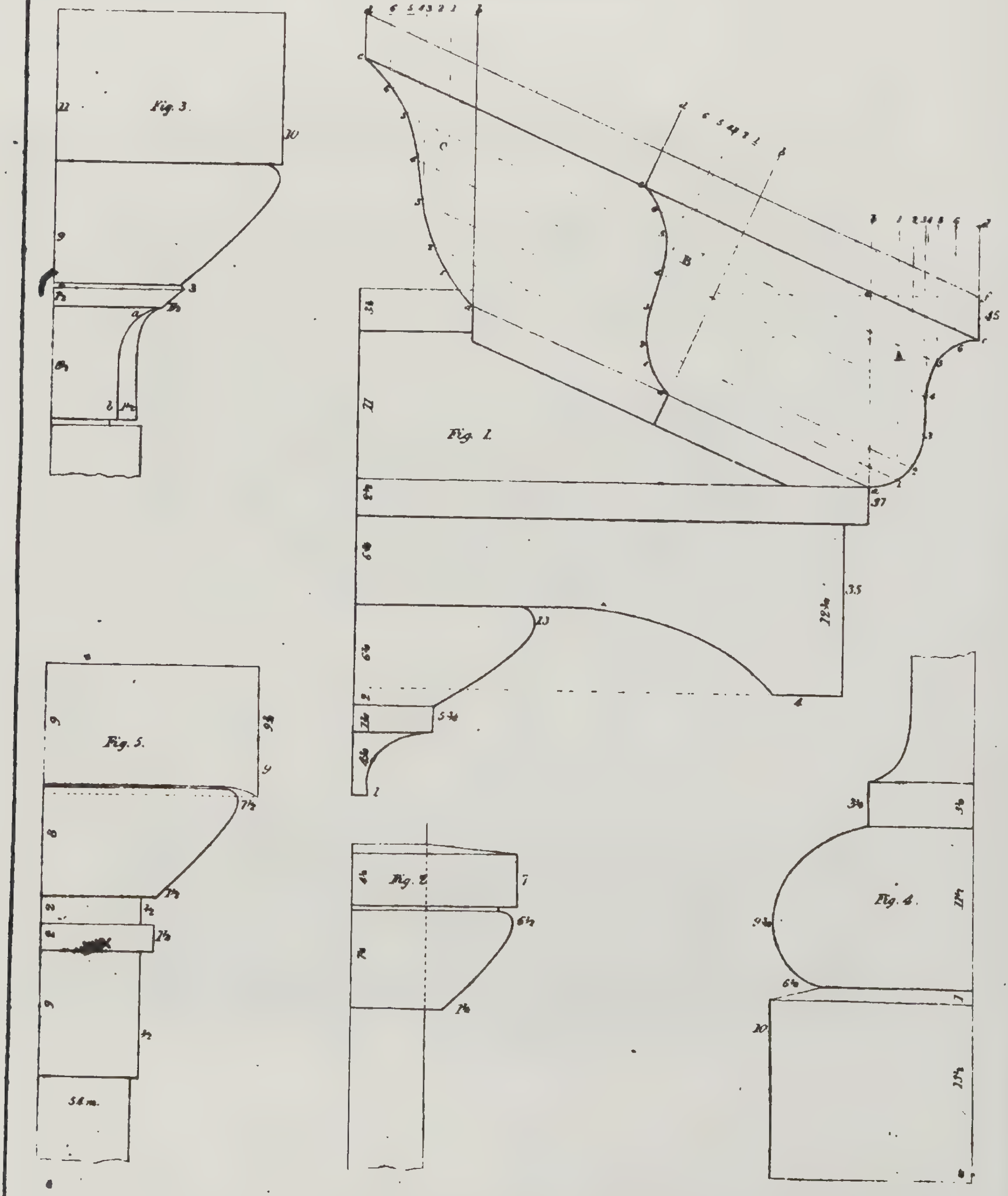


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.

trave. Fig. 3 shows those of the capital. The necking of the latter is decorated with twenty flutes, in exact imitation of Doric flutes; to the directions for fluting which, the reader is referred for a knowledge of forming these. The line *a b* shows the depth and termination of the flute under the annulet of the capital.

Fig. 4 shows an example of a base suitably constructed for this column, if one is to be employed; though it is believed that the column will generally succeed best without it.

Fig. 5 exhibits a capital for a pilaster, having the breadth of the pilaster figured upon it.

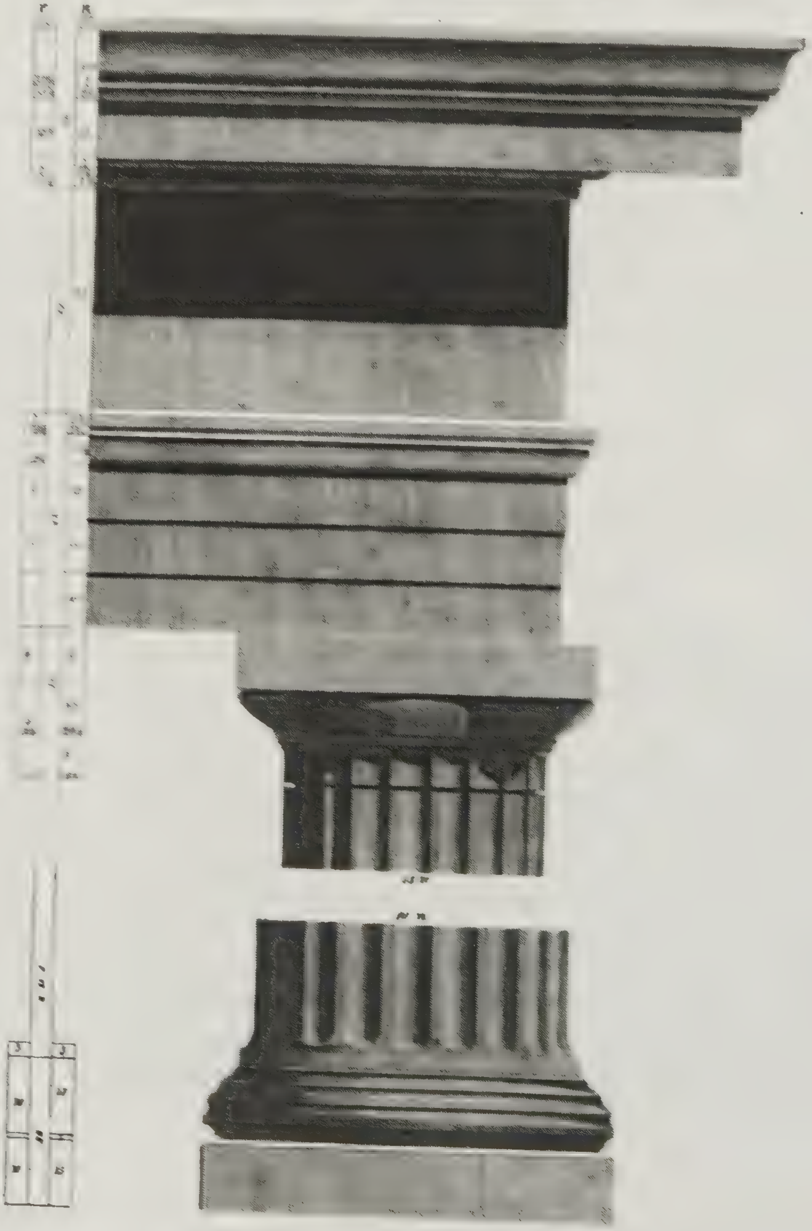
COLUMN AND ENTABLATURE.

PLATE VII.

I AM aware that the publication of anything in the shape of an order, unless it be really one of the Grecian or Roman orders, is, by persons well versed in architecture, thought to be little less than heresy. Although I am not much disposed to differ with them in their opinion, I have deemed it advisable in this case to depart from it. My reasons for so doing proceed from the fact, that more than one half of all the columns and entablatures erected in country situations, for either internal or external finishings, belong neither to the Grecian nor Roman system. The same fact holds true in relation to our cities and large towns. Any person who will take the trouble to compute the number of instances, in which some one of the regular orders is employed in any street of our cities, or villages, will be convinced of the truth of this assertion. I have made the comparison in two streets, which present more buildings of the first

COLUMN AND ENTABLATURE.

PLATE [illegible]



class, in proportion to their number, than any other streets of their length in this city, and have found the regular orders employed in only thirteen places, while other columns and entablatures were substituted in twenty-three places.

I have often inquired the reason of this, from very intelligent workmen, and have as often received for answer, that the Tuscan order is too massive and plain, the Doric too expensive, and the Ionic too rich, and that they are therefore under the necessity of composing a column and entablature which will conform to the views and purses of their employers.

With these facts before me, no doubts rest in my mind but what it would be better to give a design here of a column and entablature, constructed on scientific principles, and of a character capable of meeting the views and practice above mentioned, than to leave it to be composed by unskilful hands.

In the composition here exhibited, the shaft of the column, together with its flutes and fillets, are in imitation of that found in the interior of the Temple of Apollo at Bassæ. This column was crowned with a very singular Ionic capital, of an angular form. Its base was also singular in its composition. Neither of them, however, were deficient in beauty. The shaft has here been adopted on account of its novel, graceful and simple aspect. The flutes in their section are an exact imitation of the best Grecian Doric flutes, but differ from any of the Doric examples by being separated by very small fillets, which are in breadth equal to one fifth or sixth of the breadth of the flute. The flutes are twenty in number, and descend and terminate on the scape of the column, in an elliptical form, like their section. They also terminate at their upper extremity on the scape in the same manner. All the details of the flutes and fillets, and also those of the whole composition, are very accu-

rately drawn on a large scale and figured in minutes. Great care has been taken to give to the outline of all the mouldings the true Grecian character.

The base is in its general form somewhat like that given by Vitruvius in his Tuscan order; but the torus is elliptical, and fluted, in imitation of some of the best Grecian examples of the Ionic base. The base is not therefore either Tuscan or Ionic, but it stands in equipoise between the two.

The capital is imitated from that found on the newly discovered temple at Cadachio, in the island of Corfu. In its annulets, it partakes of both the Grecian and Roman schools; but in the remaining details it is purely Grecian, and a beautiful specimen of their system.

The entablature is two diameters in height, and is divided into three parts: the architrave, the frieze, and the cornice; the details of which have been selected with a view to economy and an adaptation to the column and to modern practice. In the cornice, the corona has a great projection and height; the crown moulding has also a great height, but a small projection. The bed-mould is somewhat singular in its form, and about one half its altitude is recessed up into the plancer of the corona, which allows the members of the cornice to be somewhat enlarged. With one single exception, each moulding of this composition is indebted to some one of the conic sections for its beautiful variety of outline. As the selection and arrangement of the elements, which compose this column and entablature, have been the cause of much research and great solicitude, I hope that, when it shall be decided not to employ either of the regular orders, this composition may be found worthy of being made a substitute.

It is supposed that the larger and better class of edifices will

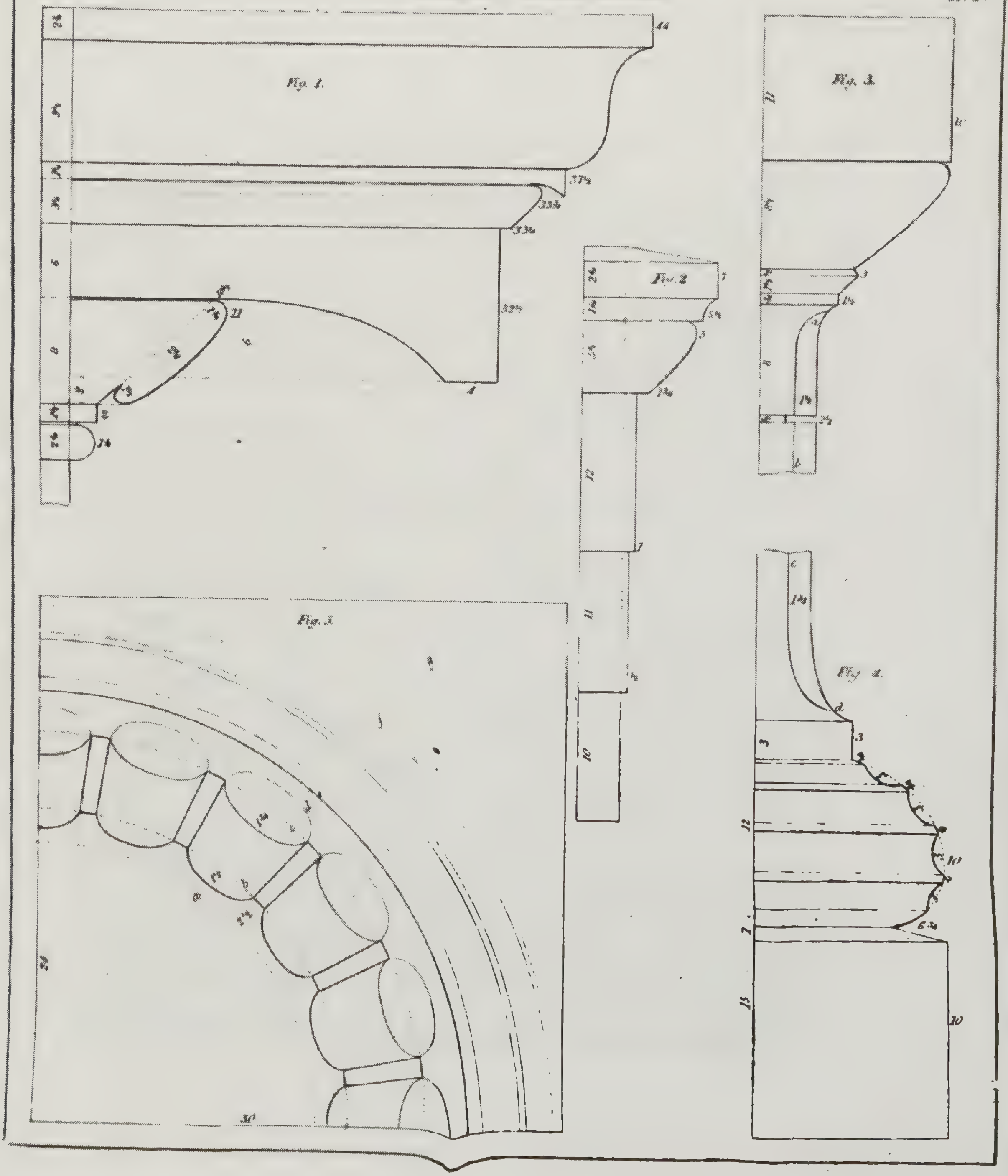


Fig. 1.
Fig. 2
Fig. 3.
Fig. 4.
Fig. 5.

always be decorated with some one of the orders, as the proprietor will be amply compensated for the difference in expense, by the chaste and classic appearance of his building. It is to be expected, therefore, that this design will be used only on the smaller and cheaper class of buildings; in which case it will seldom be required to make the column larger than the Ionic proportions, say nine diameters.

If this example is to be used for a portico, where the house is of small dimensions, the windows and door likewise being of a small size, it will be most proper to make the column, at least, nine diameters in height. On the contrary, if the house be of a large size, as also the doors and windows, it will be advisable to make the column about eight diameters in height.

PLATE VIII.

On this plate are exhibited, on a large scale, the details of the Column and Entablature of the preceding plate.

Fig. 1 represents the cornice, with its members figured in minutes. It must be remembered, that those mouldings, which are recessed up under the member next above them, show here their whole height, and they are figured accordingly. But in the preceding plate, that part only is figured which is seen in a direct front view.

Fig. 2 exhibits the outline of the architrave; fig. 3, that of the capital; and fig. 4, of the base. The lines *d c*, on the shaft of the column near the base, and also *b a*, on the neck of the column, represent the depth of the flute, and its termination at each end.

Fig. 5 exhibits the plan of the plinth and base of the column. The line *f* shows the extreme outline of the base moulding; *e*, the outline of the fillet, which joins the scape; *c*, the line encircling the lower diameter of the column; *b*, the upper diameter; and *a*, the

depth of the channel which separates the capital from the shaft of the column.

In order to flute the shaft of this column, first divide its periphery into twenty equal parts, and subdivide one of those into six equal parts. Make each flute equal to five, and each fillet to one of these parts. Make the section of the flute elliptical and in imitation of this example, which is one and three fourths of a minute in depth at the lower diameter, and one and one half minutes at the upper diameter. The lines, at the letter *d*, exhibit the termination of the flute on the scape.

THE DORIC ORDER.

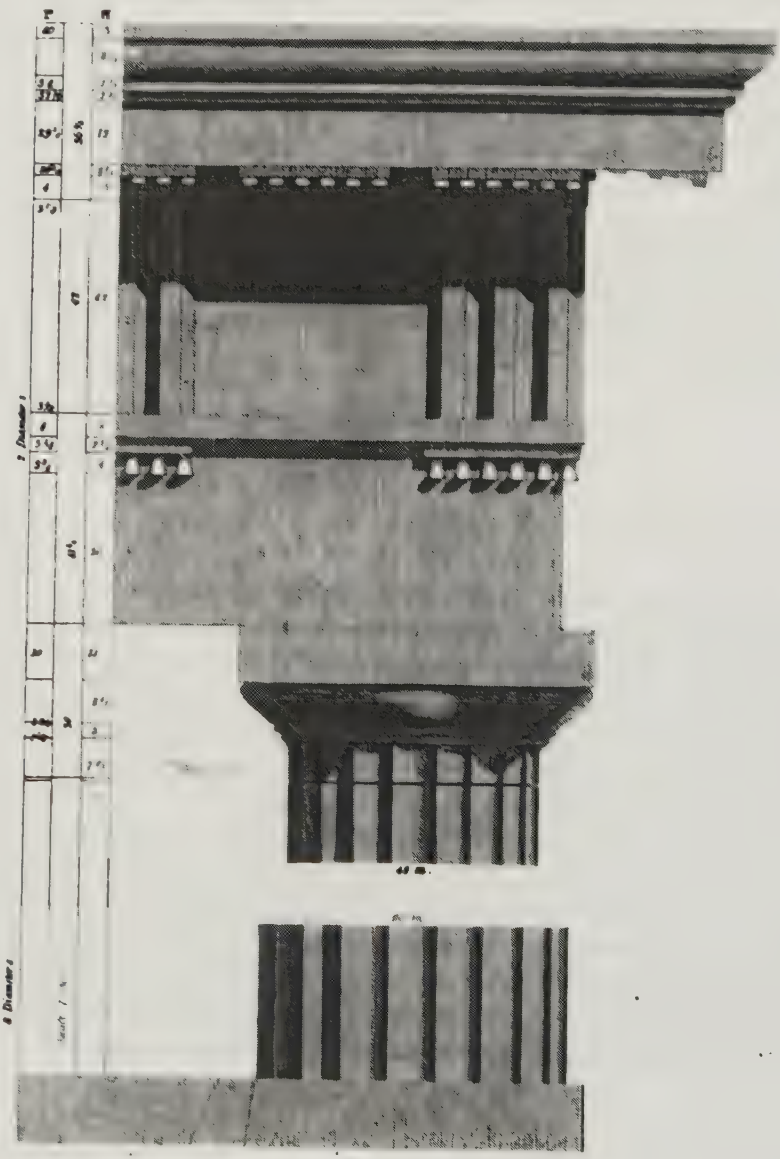
PLATE IX.

In the early practice of the Doric order, by the Greeks, the altitude of the column was usually about four diameters; but in later times, this altitude was increased to six, or six and one half diameters. Most or all of the details of the order experienced, in like manner, a change. It does not appear that any two, of even the best specimens, and those too which were erected at the same period, agree either in their general or their particular parts.

But nowhere are to be found omitted, the twenty flat flutes without intervening fillets, the triglyphs in the frieze and the mutules in the cornice, with all their appendages. These formed the distinguishing features of the order. Their distribution has always been uniform. No deviation whatever was allowed. It was by the undeviating arrangements of these elements that Grecian architects were enabled, notwithstanding the latitude used in other less impor-

PL. IX

DORIC ORDER.



tant respects, to maintain rigidly the Doric character in all their structures of that order. The Grecian architects, therefore, were not servile imitators, though followers of a general system. They evidently understood well the universal rule of proportioning the means to the end; a rule which has been mentioned here often enough to show that it is thought to be of vital importance.

The diminution of the shaft of the column was different in different examples. That of the Temple of Minerva was thirteen minutes. The lines making the boundary were straight, or gently curved outwards. The periphery was generally divided into twenty equal parts, each part being the breadth of a flute; which, in most of the best examples, commenced at the lower extremity of the column, and terminated under the first annulet of the capital. In some of the best specimens, however, the flutes extend up the column only about ten minutes, and, at the upper extremity of the column, from the first annulet of the capital down to the channel, which divides the capital from the shaft. There are also one or two fine examples, in which the column is divided into only sixteen flutes, the section of which is elliptical.

When the section of the flute was a segment of a circle, it was drawn from the summit of an equilateral triangle, whose sides were equal to the breadth of a flute. Its section was generally elliptical, and when so its depth was about the same as when a part of a circle.

The capital was divided into three parts; the abacus, the echinus, its annulets and the necking. The abacus varies from nine to twelve minutes in height, having the faces plain. Under and adjoining it, is the echinus, whose outline resembles that of a chesnut, and is, in the best specimens, either elliptical or hyperbolical. This moulding, together with the annulets, is generally equal in height to the abacus.

The annulets are in number from three to five, falling off under each other vertically, like an inverted flight of steps, and partaking of the general outline of the echinus in the arrangement of their angles. In the best examples, at about thirty minutes below the top of the abacus, is a channel, of about one half of a minute in breadth, and three in depth, sunk equally all around the shaft, which divides the capital from the shaft of the column.

The height of the entablature varies in different examples. The example taken from the Temple of Minerva, on the Acropolis, which is one of the most perfect specimens of the order, is very near two diameters in height. It is divided into three parts ; the architrave, the frieze, and the cornice. These members, also, vary in different examples. The architrave and the frieze in the same examples are very nearly equal in height. The height of the cornice varies from twenty-one to thirty-two minutes. The frieze and architrave of the Temple of Minerva are each forty-three, and the cornice thirty-three minutes in height. The face of the architrave is always one uniform plane, divided from the frieze by a band or tenia of rectangular form, which continues along the entablature in one unbroken plane. Under this band, and immediately under each triglyph, are regula, or fillets, to which are attached six conical drops. The ends of each regula, and the extremities of the drops, are in the same vertical line with the edges of the triglyph above. The drops are frustums of very acute cones, approaching nearly to cylinders. Their height never exceeds three-fourths of their diameter at the base.

The frieze is decorated with triglyphs and metopes. The triglyphs are from twenty-seven and one half to thirty-one minutes in breadth, and about three minutes in thickness. Their length is equal to that of the breadth of the frieze. The angle of the frieze

is always finished by two triglyphs, meeting each other in such a manner that the channels are common to both. The metopes in the temples of Theseus and Minerva, were enriched with historical representations of the most exquisite workmanship. None of the embellishments, however, were allowed to project much beyond the frame which enclosed them.

The cornice is a distinguished feature in this order. It has a sloping plancer to indicate the inclination of the rafters in the roof; and under the plancer, mutules, with three rows of drops, six in each row, hung to their under surface.. The mutules are equal in breadth to the triglyphs. They are so distributed, that the centre of one is exactly over that of a triglyph; and of another, exactly over the centre of every metope. The centres of a mutule and triglyph are to range over that of each column, except the one supporting the angle of the entablature. The corona is very broad, and the crowning moulding, in most of the examples, and in all of the best specimens, is composed of a cymatium and fillet, or ovolo with a fillet above it.

This ancient order, as practised by the Romans, and also by the moderns until after Stuart and Revet published their splendid work on Grecian architecture, lost much of its original character. It does not appear to have been much a favorite among the Romans, who have left us but few examples of it. That of the Theatre of Marcellus is esteemed the most perfect. The column of that example is seven diameters and fifty-eight minutes in height, without a base, and stands on a step. The shaft of the column is not fluted. The capital consists of three parts; the abacus, the echinus with its annulets, and the necking. The abacus is capped by a cymatium, which renders its appearance so small and trifling that it will not compare with the Grecian original. The outline of the echinus is

a part of a circle, and consequently likewise inferior to the Grecian original, which is either an ellipsis or an hyperbola. The annulets under the echinus are large, and well proportioned to themselves and to the capital.

The capital is finished by a necking, encircling the column at about thirty minutes from the upper extremity of the abacus. This necking, in imitation of that employed at the base of the Corinthian capital, is a substitute for that graceful channelling, which encircles the neck of every Grecian Doric column, and is one of the characteristics of the order.

As a part of the cornice of this example is wanting, the exact height of the entablature cannot be ascertained; but it could not have been far from one diameter fifty-three minutes. The architrave is thirty-one minutes in height; the frieze, forty-six; and the cornice, thirty-six. The architrave is in one plane, capped by a tenia of rectangular form, also in one plane. Under each triglyph is a regula, whose length is equal to the breadth of the triglyph, to which are hung six conical drops. The face of the frieze recedes about two minutes from the vertical line of the architrave. The triglyphs, therefore, project about one half of their thickness, or two minutes. They are thirty-one minutes in breadth, and forty-five minutes distant from each other, and are decorated on the face with two channels and two half channels. A centre of a triglyph is placed over the centre of each column. The cornice has a sloping plancer, ornamented with mutules, one over each triglyph, and enriched with three rows of drops, six in each row. Both mutules and drops are recessed up into the corona behind a small moulding, so as to be wholly concealed from a direct front view. The next member below the mutules is a denticulated band, supported by a cymatium. The corona and crowning moulding are both large and

well proportioned. The cornice has a great projection, and is well proportioned to itself and the entablature; nevertheless, the beautiful dentil in this cornice is out of its place, as it belongs peculiarly to the Ionic cornice, of which it is characteristic.

There were other examples of the order discovered among the Roman antiquities, which were very rich and beautiful, although the legitimate Doric character had been departed from.

That at Albano, near Rome, holds a high rank amongst the Roman examples. Its general proportions do not differ essentially from those of the Theatre of Marcellus. The column is left plain; and in the capital an astrigal is substituted for the annulets. The echinus and cymatium of the abacus are both enriched. The architrave is divided into two faces, and separated from the frieze by a bead, with a fillet above and a fillet below it. This moulding is broken over the triglyphs, and the drops under it are hung from the lower extremity of the fillet. The triglyphs in the frieze are so distributed as to form the metopes into a geometrical square; and the metopes themselves are decorated with sculpture of a very rich character. A mutule is placed directly over each triglyph, the edges of which are composed of a cymatium with a fillet above it; and, hung to its plancer, are thirty-six conical drops, six in front and six in flank, whose lengths are equal to their largest diameter. The mutule finishes against a band, or fillet, which is immediately above the capping and separated by it from the triglyph. The corona has a great projection, and together with the crown moulding has likewise a very respectable breadth. The cornice and frieze are well proportioned to each other and to the whole composition. They partake more strongly of the original Doric character than those of any other Roman example. The architrave is too low and in bad taste. The capital is too rich; and, in imitation of all the other Roman

examples, a clumsy necking is substituted for the beautiful channelling of the original Doric column.

In selecting the example here offered to the public, my intention has been to adopt such parts of the ancient examples, without regard to the school or country from whence they were taken, as after due consideration were supposed to be best adapted to the present practice.

I have given eight diameters to the height of the column, in imitation of Roman and modern practice; and to the entablature, two diameters of the column; because, after a long practice and due consideration, I am persuaded that, for a general proportion, it is to be preferred to any other, and that the average of the Grecian entablatures were nearly of this height.

Sir William Chambers and some other modern architects have proportioned the entablature by the height of the column, and not by its thickness, making it one fourth part of that height. This practice should not be imitated. A Doric column, one foot in diameter, would be eight feet in height. The above rule would give one fourth of this height, or two feet, to the height of the entablature. But a Corinthian column, one foot in diameter, would be ten feet in height; and therefore the same rule would make the height of the entablature two feet six inches. Now it will be readily admitted, that the Doric column, of one foot in diameter and eight feet in height, is capable of sustaining a greater weight than the Corinthian column of the same diameter and ten feet in height. This rule is therefore defective; because the Corinthian column would not be capable of sustaining so heavy a weight as the Doric, at the same time that it would be loaded with an entablature one fifth higher than that of the Doric. On the authority of Vitruvius, we suppose that the proportions of the Doric order were taken from those of a

robust man ; and of the Corinthian, from those of a young female ; and it appears inconsistent to load the latter, therefore, with a greater burden than the former.

It is not however supposed that two diameters of the column will at all times and in all places be the best proportion for the entablature. Circumstances may require the proportion to be varied. When used for inside finishing, or any other place where lightness is desired, the entablature may be lowered to one hundred and ten or fifteen minutes; and when it is charged, or apparently charged, with any very heavy burden, it may in that case be raised to the height of an hundred and twenty-five or thirty minutes.

There is not, to my knowledge, a single instance among all the ancient examples of this order where a base is added to the column, the column being so large as not to require one for the sake of an appearance of stability.

In this example I have adopted the ancient practice. There may, however, cases arise in practice, where it would be proper to add a base ; as, for instance, when the whole composition is small, and the column apparently required to support some heavy burden ; and, when the lower extremity, viewed in connection with the burden upon the column, does not appear capable of sustaining the weight without indenting itself into the plinth or step on which it stands ; in which cases the attic base would add to the beauty and apparent stability of the whole composition.

In the fluting of the column, and also in the formation of the capital, the Grecian practice has been imitated, with one deviation ; which deviation is to be found in the number of annulets in the capital. In the Grecian practice, from three to five was the constant number employed ; but the largest number occupies a space of only two minutes, which, when divided into nine lines or angles,

the number required for their formation, reduces each member to so small a space as to render it indistinct. They are not therefore in keeping with the massive details of the remaining parts of the order. In this example the Grecian arrangement of the annulets is preserved, but the number is reduced to two.

In the divisions of the entablature, the Grecian practice has been imitated. The frieze is in one plane, capped by a tenia, under which, and directly under each triglyph, is a regula, to which are suspended six drops or guttæ. They are not in imitation of either the Greek or Roman practice, but a mean between the two.

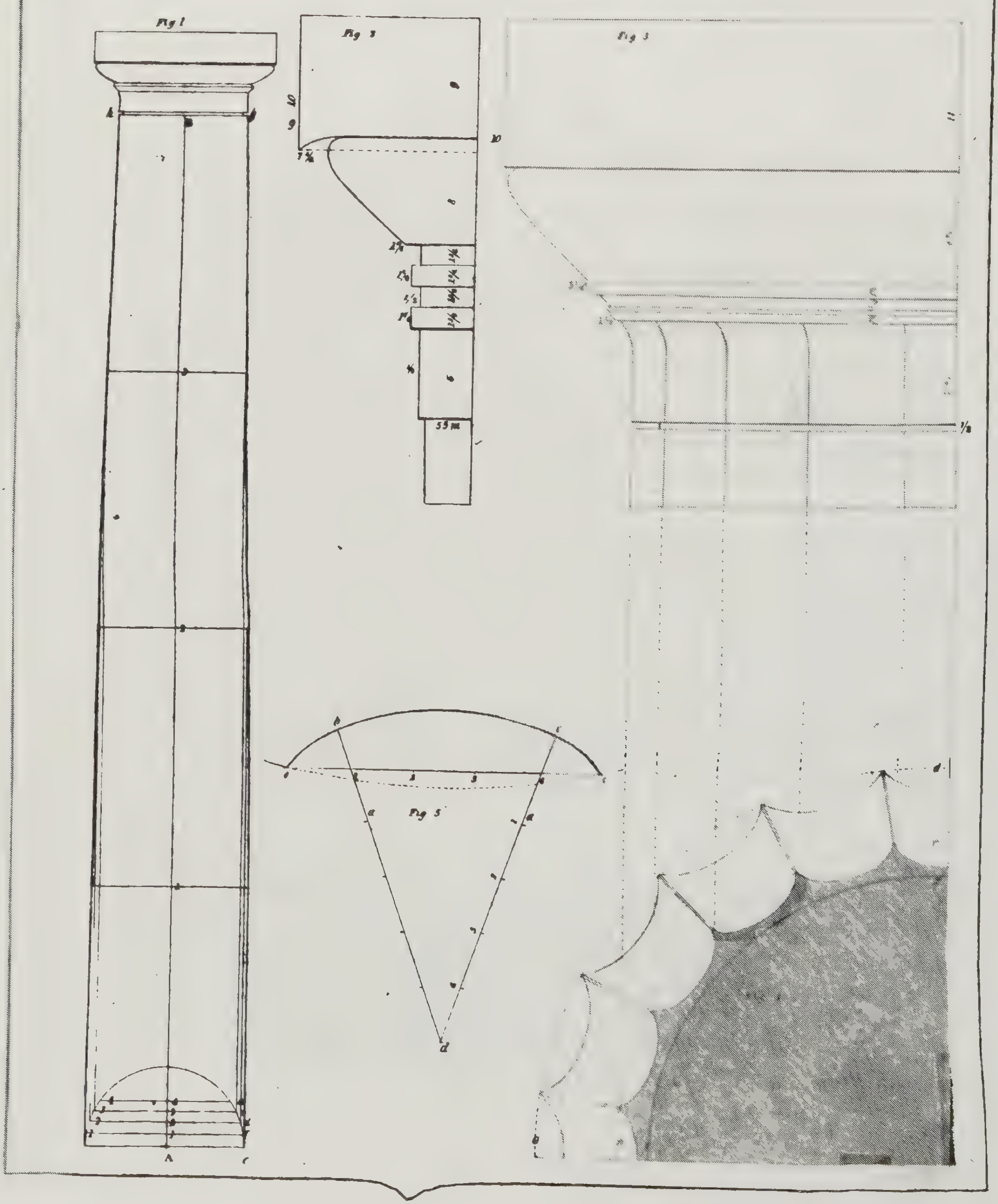
The angles of the frieze are finished by two triglyphs, meeting each other so that the half channels on the edges of each triglyph are in the same plane. The triglyphs are thirty minutes in front, and seventy-five from centre to centre, leaving the metopes forty-five minutes. A triglyph must be placed exactly over the centre of each column, except those which support the angles of the entablature. Under the plancer of the cornice, and directly over each triglyph, and also over each metope, is placed a mutule, whose width is equal to the breadth of the triglyph; and to the under surface of each mutule are hung eighteen drops in three rows, of six in each row.

PLATE X.

Fig. 1 exhibits a method of diminishing the shaft of a column in the Roman style. Let the line A B be the centre and height of the shaft. On A, with a radius of one half of the diameter at the base of the column, describe the half circle *o c*. Draw 4 *a*, parallel to *o.c*, and equal to the diameter of the column at its neck. Divide *o* 4, on the circular line, into four equal parts, and join 3 *e*, 2 *d*, and 1 *f*. Divide A B into four parts. Make the diameter at 1 equal to 1 *f*;

DORIC ORDER.

Pl. 10



at 2, to 2 *d;* and at 3, to 3 *e;* and draw the curve lines *o h* and *c g*, which will give the outline required.

This method of diminishing columns is introduced here, because custom seems to require it, and not as a recommendation for its use. I do not know of any situation where the Grecian system is not decidedly preferable. It is said that the shafts of columns were at first made of trunks of trees, and afterwards in imitation of them. But although the trunk of a tree diminishes upwards, yet the lines of its sides are straight, or nearly so; so that the Grecian architects showed their wisdom in closely adhering to this natural and graceful form. It is well known that a column, whose sides are in straight lines, will appear as though its sides were gently curved inwards; for which cause the Grecian architects undoubtedly made the sides of their columns to swell gently outwards, with the intention that they should appear to be straight to the eye. This practice should be imitated.

Fig. 2 exhibits a design for a capital to a pilaster; fig. 3, that of a column. Fig. 4 shows one quarter of the plan of the column at both base and neck, having described upon it the section of the flutes. The dotted line *d a* is the boundary of the diameter at the base, and *e b* that at the neck. The line *c f* shows the depth of the channel, which separates the shaft from the capital. Fig. 5 shows a method of describing the outline of a Doric flute by centres. Divide *o* 5, the breadth of a flute, into five equal parts; and on *o* and 5, with a radius equal to *o* 5, make the intersection *d;* and from *d*, through the points 1 and 4, draw lines produced to *b* and *c;* then divide each of the lines *d* 4 and *d* 1 into five equal parts; on *a* and *a*, with the radius *a* 5 or *a o*, describe *o b* and *c* 5. Lastly, on *d*, with the radius *d c*, or *d b*, describe *b c*.

This method of describing a flute by centres has been exhibited

more for the purpose of showing the student some rule by which he may be governed in relation to the general shape and depth of the flute, than of recommending it as the best method of forming the outline. It should be remembered that a real ellipsis is in all situations to be preferred to an imitation made by parts of circles.

PLATE XI.

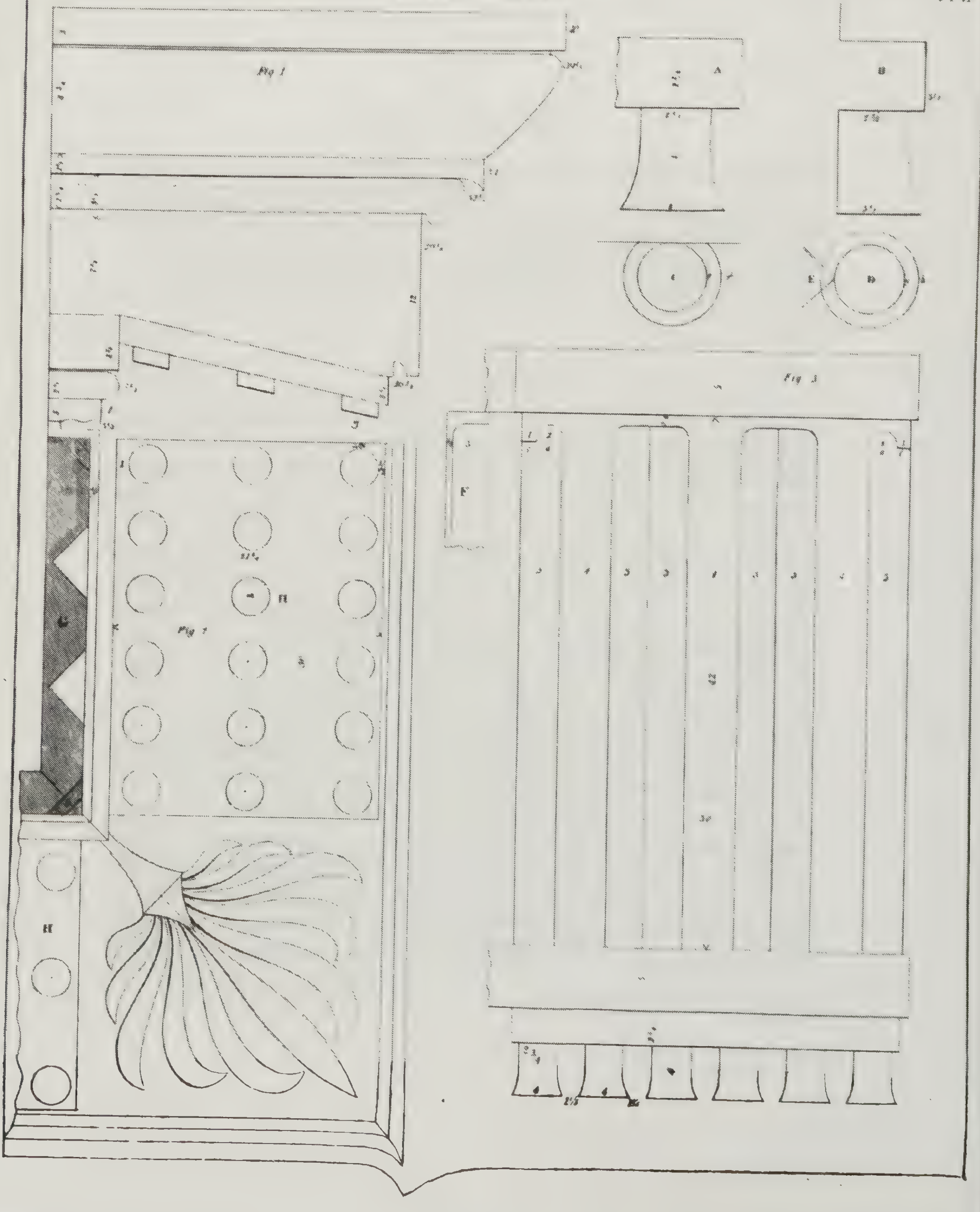
On this plate are represented the details of the Doric Entablature, the outlines of which are accurately drawn on a large scale, and figured with all those members uncovered, which are necessarily concealed in a direct front view behind the member next above them.

Fig. 1 exhibits the cornice with the plancer inverted. H H shows designs of the mutules, with all their parts figured in minutes. G shows a section of the triglyph with its cap. The honeysuckle here introduced was frequently employed in the best Grecian examples to decorate that plain part of the plancer, and it is admirably adapted to that purpose. It may, however, be left off with propriety, when expense is to be avoided, or when plainness is desired.

Fig. 3 exhibits an example of the triglyph with its details, all of which are accurately figured in minutes. A represents a front, and B a side view of one of the guttæ, drawn on a large scale. C shows the inverted plan of A, and D that of B. The circular line *f* encloses the base of A and *e*, the neck. B is supposed to match the angle of the architrave, as is shown at E. *h* at D shows the larger, and *g* the smaller diameter of the guttæ. F shows the depth of the channelling of the triglyph, and also its form at its upper extremity.

DORIC ORDER.

Pl. 11



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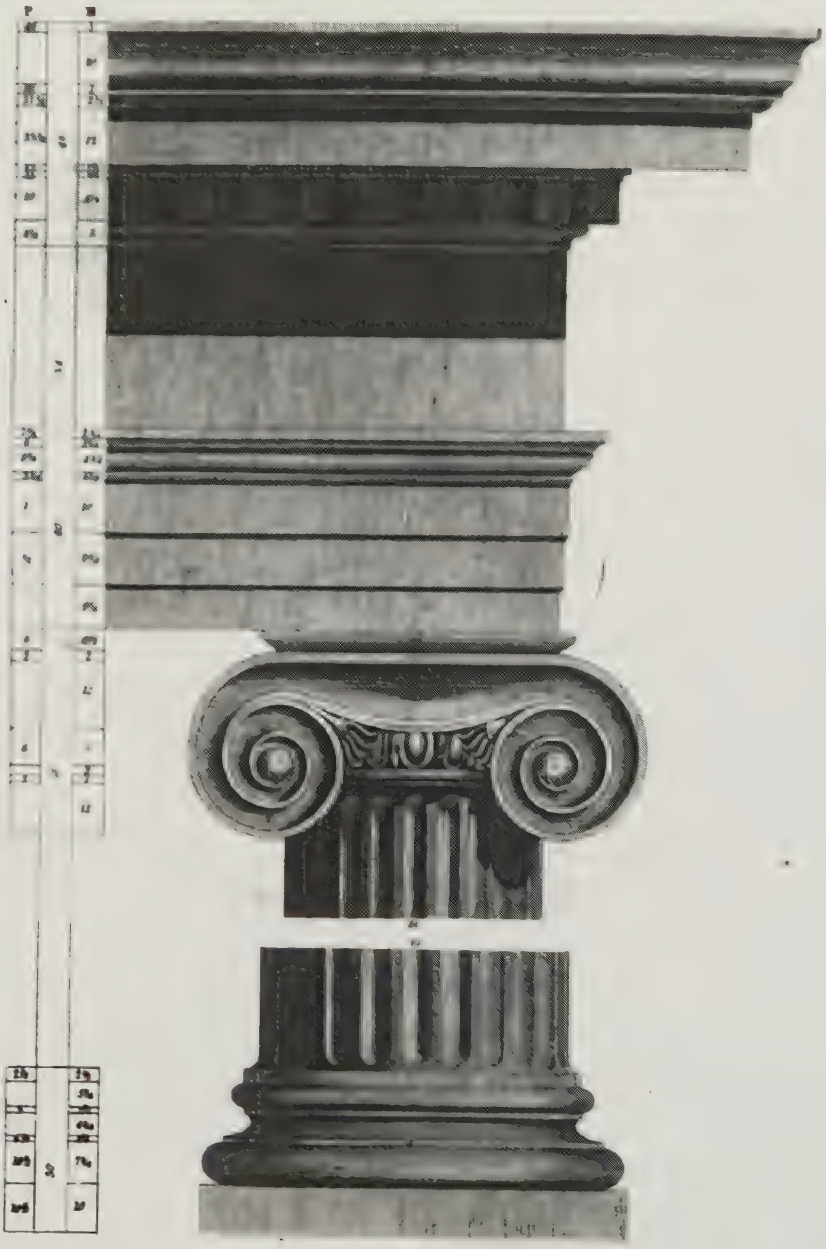


THE IONIC ORDER.

PLATE XII.

I shall here speak of the examples and practice of this order by its original proprietors, the Greeks, and likewise by the Romans.

There have been many fine examples discovered among the antiquities of Greece: and although, like the Doric, the Ionic order appears from these examples to have been practised by the Greeks with great latitude; since some were decorated with a profusion of mouldings, which were covered with the most beautiful enrichments, while others had but few mouldings, and these exceedingly plain; yet all adhere strongly to a certain original and peculiar form.

The height of the column was originally eight diameters. Its shaft was decorated with twenty-four flutes, and as many fillets. In many of the best specimens, the flutes descended and followed the curve to the scape of the column. The base was generally about one half of the diameter of the column, and wholly composed of mouldings; the step on which it stood, answering for a plinth. When of the attic kind, the scotia was very flat, its section forming an elliptic curve, and was divided from the upper torus by a fillet. It generally projected as far as the extremity of the torus, and was therefore very much exposed to fracture, especially if of small dimensions. It had a very unsolid aspect, and was in fact inferior in solidity and fitness to the attic base, as practised by the Romans. The base to the columns of the Ionic Temple, on the river Ilyssus, had its upper torus fluted.

The great distinguishing feature of the Ionic order, is the capital. In the best specimens, the lower edge of the channel, which runs

between the volutes, is formed into a curve bending downwards in the middle and revolving about the spirals on either side. In some examples, each volute has two channels, formed by two distinct spiral borders. The borders forming the exterior volute and the under side of the lower channel, have between them a deep recess, or spiral groove, which diminishes gradually in breadth till it is lost to the eye.

In this last example, there are so many spiral lines revolving about the eye, that, unless the volute be extremely large, the parts will appear confused and indistinct. It will not therefore be the best example for imitation.

One of the best examples of this capital, for imitation, is taken from the Temple on the river Ilyssus. The simple dignity and grandeur of its parts, the beautiful contour of the volutes, and the graceful curve of the hem hanging between them, are in themselves calculated to render it superior to most others. Another very beautiful and more ornamented example of this capital is taken from the Temple of Minerva Polias, at Priene. The proportions are somewhat varied from those of the last example; but they are equally elegant and worthy of imitation.

In most of the Asiatic remains of this order the frieze is missing, and therefore the height of the entablature cannot be accurately ascertained. The only instance in which a frieze has been discovered, is in the Theatre at Laodicea. There, it is somewhat less than one fifth of the height of the entablature. In the Asiatic practice, great deviations were allowed. For instance, in the little Ionic Temple near the river Ilyssus, we see the cornice deprived of its legitimate ornament the dentil, and the architrave separated from the frieze by an ovolo, which was finished by a bead below, and above by a fillet, the fascia of the architrave being very broad and in

one vertical plane. The bed-mould consists of a cima-reversa, finished below with a bead, both of which are recessed up into the soffit of the corona. The corona has a great projection and height. The crown-moulding is a cima-recta of great height and small projection, separated from the corona by a cymatium and fillet. The mouldings are all left entire, without any enrichments whatever.

In other examples, such as the Temple of Bacchus at Teos, and the Temple of Minerva Polias at Priene, the entablatures have the dentil, accompanied by a number of chaste and appropriate mouldings, the contours of which are ornamented with a profusion of delicate enrichments. Although a marked difference is to be seen in the proportions of these two examples, they are, notwithstanding, both of them extremely beautiful. The architrave is composed of three plain fasciæ, separated from the frieze by an ovolo, which is finished below with a bead, and above with a cavetto and fillet. It has before been stated that the frieze was missing, and it cannot, therefore, be ascertained whether it was ornamented or plain; but as the other parts of the composition were highly ornamented, it is reasonable to suppose that this member was so likewise. The cornices in these two examples do not differ essentially, the dentil being common to both; but, in the Temple of Minerva, they are singularly prominent, having a projection equal to that of the modillion employed in this order by Palladio and other modern architects. The moulding which separated the dentil from the frieze is wanting; but probably it was an ovolo and a bead, like the one which crowns and finishes the bed-mould. This moulding is recessed up into the soffit of the corona, which nearly conceals its height. The corona has a great projection, and is finished above by a cymatium and fillet, and crowned by a cima-recta of great height and small projection. In all the Asiatic Ionics, the crownings of the cornices are cima-recta less in projection than in height.

Among the Roman examples we observe great deviations, the effect of which is to degenerate the beautiful Ionic, so happily preserved in all the Greek examples. In the shaft of the column no marked difference appears to have existed, except in the example from the Temple of Fortuna Virilis at Rome, which had only twenty flutes and as many fillets. The base of this example is of the attic kind, and its details are well proportioned to themselves and the columns. Taken as a whole, it is a beautiful specimen, much superior in arrangement and effect to any of the Asiatic Ionic bases. The different members of which the capital is composed, do not bear that harmonious proportion to each other which appears in the beautiful Greek original. The echinus, and the astragal below it, are too massive for the remaining part of the composition, and the space between the upper extremity of the echinus and the lower edge of the fillet of the volute is too small. The entablature is one hundred and thirty-eight minutes in height. The architrave is thirty-nine minutes, of the same height, and is divided into three fasciæ, the upper edges of which recede about one fourth of a minute from a vertical line. The middle fascia is singularly decorated with an ornamented bead, situated near its centre, and is capped by a very flat cima-reversa and a broad fillet above it. The frieze is twenty-nine minutes in height, and is profusely ornamented. The cornice is seventy minutes in height. Its bed-mould is composed of a dentil band, faintly marked, and is separated from the frieze by a cima-reversa with its fillets, and a band of singular shape, above which is an ovolo, which finishes the bed-mould

The corona is very low, and in shape and arrangement resembles that in Palladio's Tuscan order. The mouldings above it consist of a cymatium, a broad fillet and a cima-recta, of great height and projection. All the mouldings in the entablature, except the cymatium under the crown moulding, are highly enriched.

A leading defect in this cornice is, that the corona does not sufficiently predominate over the other members. It seems to have lost its honorable station as principal. This defect might have been removed by giving to the corona more projection and more height. Another striking defect is in the too great abundance and magnitude of the mouldings, particularly of those above the corona. The cornice occupies the large space of seventy minutes, which is in itself a defect, incapable of being remedied by the most judicious distribution of its details.

The next Roman example of which I shall speak, is taken from the Theatre of Marcellus at Rome. The capital is more defective than that last described; but in the entablature, the proportions are more judiciously arranged. The cornice is not so massive, nor so abundant in mouldings. The architrave is composed of three plain fasciæ, separated from the frieze by a cima-reversa and fillet. Although this entablature, both in the whole and in its parts, is decidedly preferable to that of the foregoing example, still it falls far short of the Greek originals, and is not therefore worthy of our imitation.

Another example, taken from the Coliseum at Rome, is, in its entablature, divided into three parts. The architrave is similar to the one last described, having the fasciæ not in a vertical line, but receding by their top edge about three-fourths of a minute. The frieze is plain. The bed-mould of the cornice is composed of a dentil, finished below by a cymatium, and above by an ovolo. The corona has a good projection, and is tolerably high. The crown moulding is composed of a cymatium, fillet and cima-recta of good proportions. The capital is slightly finished, the volutes ending after about one and a quarter revolutions. It is in its proportions similar to the two last described.

Only one more Roman example will be mentioned, and this not as an example worthy of imitation, but that we may avoid it.

This example is from the Temple of Concord at Rome. The capital being of the angular kind, its volutes are very small and bolstered up on a series of mouldings of large size and not at all adapted to the capital. Although the mouldings are highly enriched, yet the capital is defective in all its details, no one seeming to be well adapted to the place it occupies.

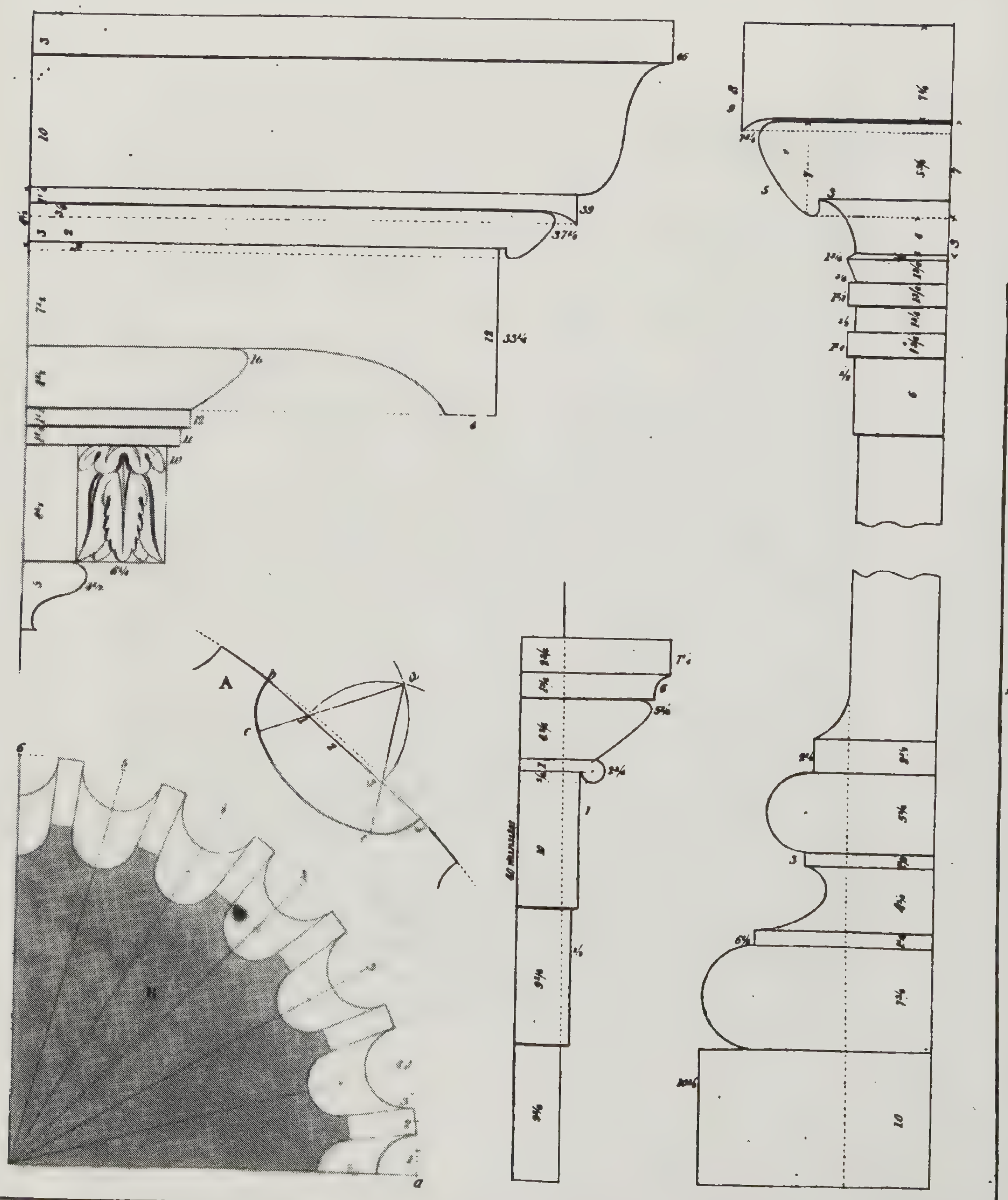
The architrave consists of two plain fasciæ and a cavetto. The projection of the frieze is equal to that of the architrave. The architrave did not extend across the front of the temple. The whole space between the lower extremity of the cornice down to the capital is in one plane, without any intervening moulding.

The cornice is of itself singularly constructed. In the bed-mould it has dentils and mutules, the dentils being small and the mutules of a novel construction. The plancer of the cornice is enriched with a panel recessed up into the soffit of the corona, and between each two of the mutules, in which is a very rich rosette. This cornice, with some alterations, might be used with success in many situations; but it does not belong to the legitimate Ionic.

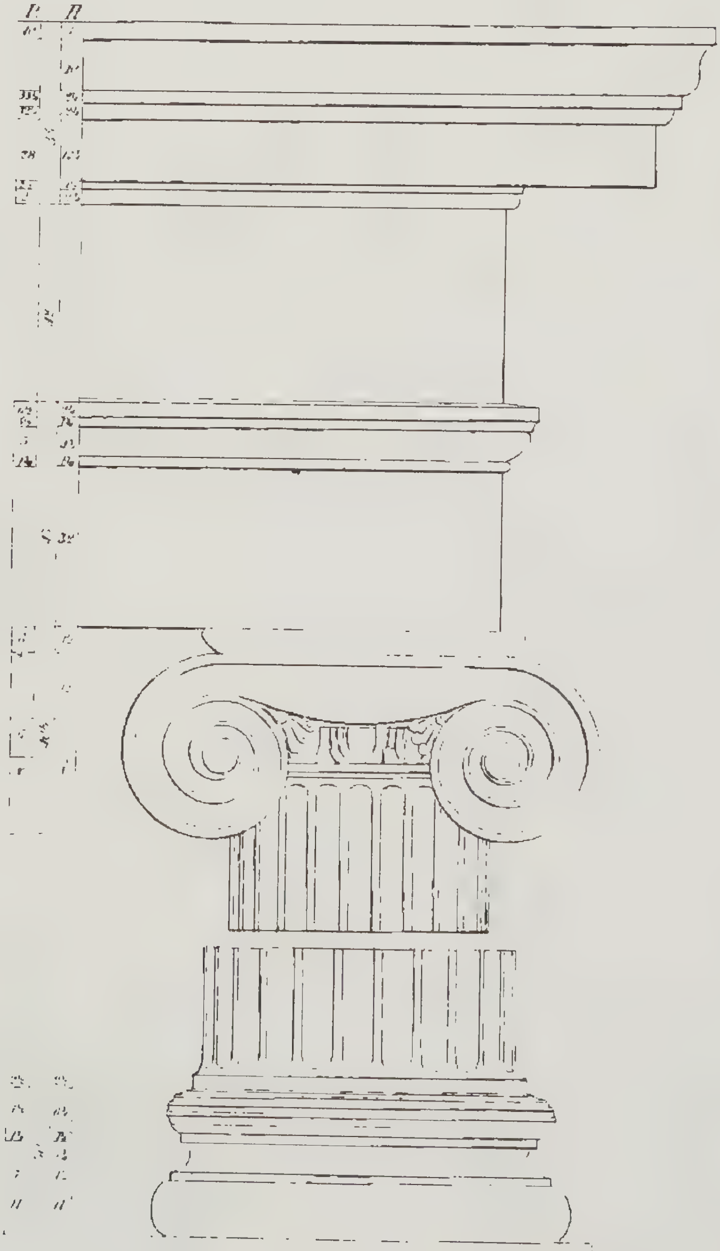
The example here exhibited is decidedly Grecian, the base being the only member which can claim any affinity to the Roman practice. The different members of this composition have been carefully selected from the most approved specimens of this order, with such deviations therefrom as were supposed necessary to adapt them completely to the American practice. Nor were they hastily brought into the form which they now assume; for my practice, as an architect, has favored me with frequent opportunities of having this example* wrought by the most skilful workmen, and of removing

* The other orders, and nearly every example, in this publication, have gone through the same process as that of the Ionic order.

DETAILS OF THE IONIC ORDER



IONIC ORDER. Pl. 14.



original defects, after a diligent examination of each member separately and collectively.

The column is here supposed to be nine diameters in altitude ; a height which seems to be the standard for modern practice. Its base is attic, and in imitation of the Roman practice. The shaft of the column is divided into twenty-four flutes, and as many fillets. The capital is, with some deviations, taken from that found on the Ionic Temple on the river Ilyssus at Athens. The entablature is two diameters in height. The architrave is divided into three fasciæ, of nearly equal height. The cornice is decorated with its legitimate ornament the dentil.

PLATE XIII.

On this plate are exhibited the details of the Ionic order. Those of the preceding orders having been fully illustrated in their proper place, it is hardly necessary to repeat nearly the same explanations here.

B exhibits a plan of one quarter of the column at its base, and also at its neck, with the flutes and fillets drawn thereon. It has been stated before, that twenty-four flutes and as many fillets are the constant number employed to decorate the column. If you divide this quarter, therefore, into six parts, and one of these again into four parts, three of the latter will be equal to the breadth of a flute, and one to that of a fillet. On 1, 2, 3, 4, 5, and 6, as centres, describe the flutes. The outline of each flute will then be one half of a circle ; which is, perhaps, the most suitable shape for the section of the flute, if the column be of small dimensions and does not exceed about fifteen inches in diameter ; but if its size be much increased, it will be wise to cause the outline of its section to form

an ellipsis, the breadth and depth of which may be in about the proportion of A. A section of the latter kind is drawn, by dividing the breadth of the flute into four parts, and on 1 and 3, and with the radius 1 3, making the intersection *a*; through 1 and 3, drawing *a* 1 produced to *c*, and also *a* 3 produced to *e*; on 1 describing *b c*, and on 3 describing 4 *e*; and then on *a* describing *e c*.

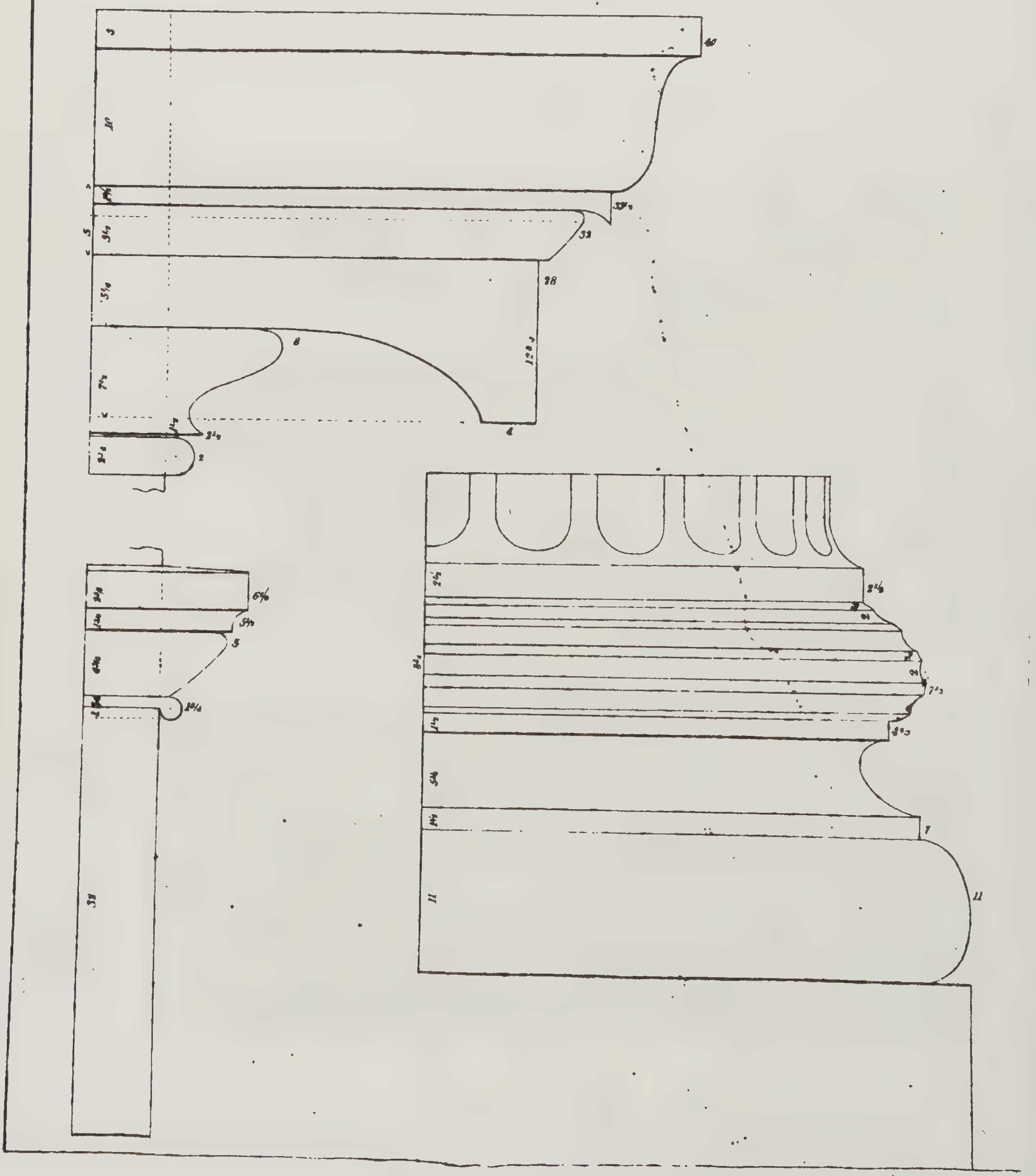
It may be asked by some, why the section of a flute should be a half circle on a column of small dimensions, and an ellipsis on one of large dimensions. The reasons are, that a flute of one inch or less in breadth will not be too strongly marked when its depth is equal to one half of its breadth; nor is the tasteless outline of a half circle so apparent in that case as in a flute of larger dimensions. And again, when the flutes are of large dimensions and wrought on stone, the elliptical form saves considerable labor; and if made of wood, the same form will not require planks of so great thickness as the half circle.

Second Example of the Ionic Order.

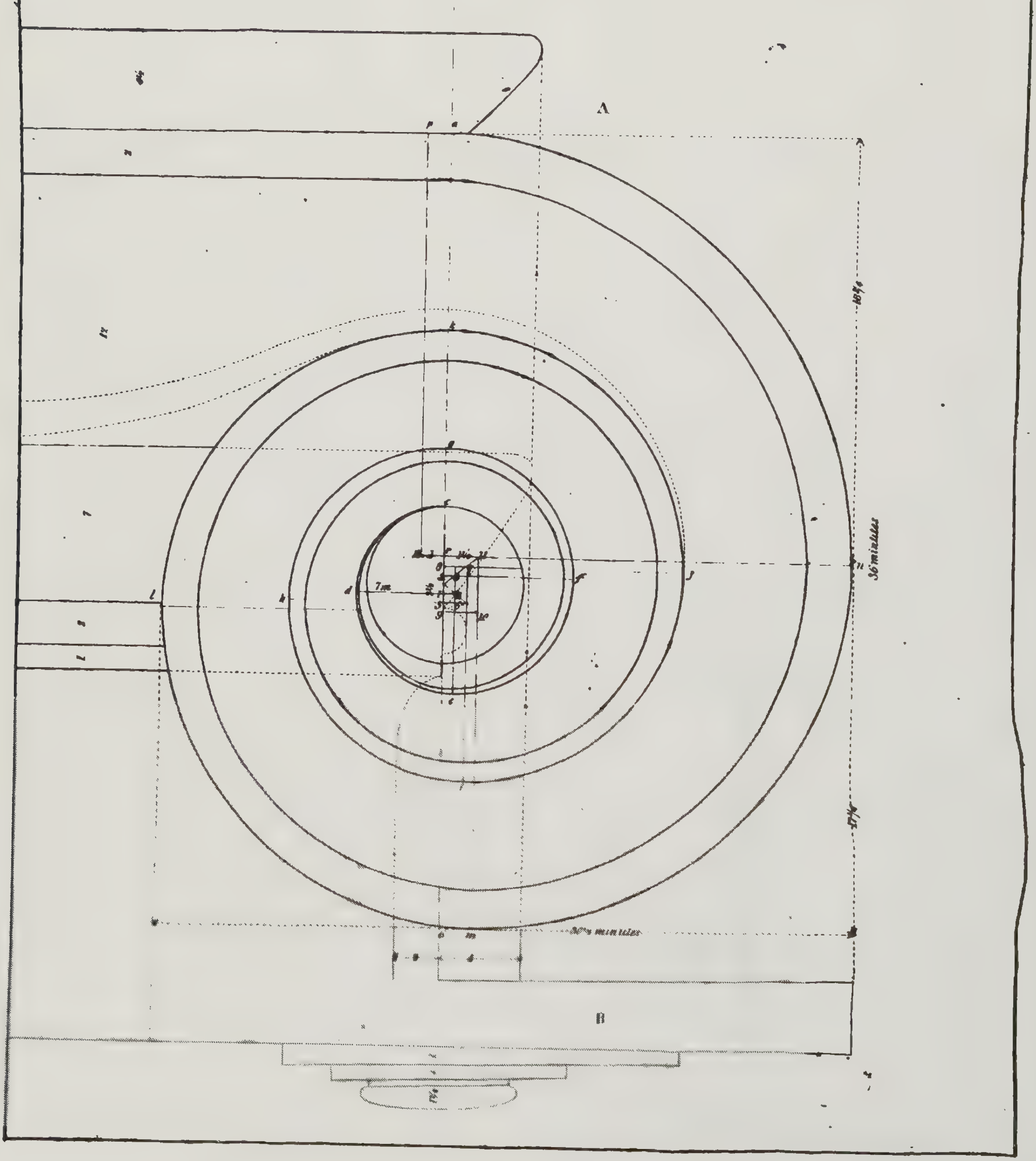
PLATE XIV.

This example is in imitation of that taken from the little Ionic Temple near the river Ilyssus at Athens, with such deviations as were supposed necessary to adapt it to modern practice. The column is an exact fac-simile of its prototype, with the exception of a little more diminution in the shaft. The base is without a plinth, and the upper torus is fluted. In the proportion of its mouldings and their outlines, a considerable deviation is perceptible. In the capital, the height of the volutes is exactly equal to that of the original; but their breadth is somewhat reduced, so that they approach near to the elliptical form. The fillet which forms the

DETAILS OF THE IONIC ORDER.



IONIC VOLUTE.



boundary of the volutes is plain, the bead in the original being left off. This fillet is not in a vertical line, but projects in its course to the eye about one minute. The honeysuckle, whose stem springs from the point of separation between the volute and hem, which connects the two volutes, is somewhat enlarged, and extends down over a part of the echinus.

The entablature is only two diameters in altitude. The architrâve and frieze are nearly equal in height. To the band of the architrave is added one moulding more than is found in the original. The frieze was ornamented with sculpture; and the circumstance that a large space was required to give it sufficient boldness, was probably the cause of the entablature being made of an extraordinary height, and of the bed-mould being reduced in size. It was wholly recessed up into the soffit of the corona. In this example, as the frieze is plain, the bed-mould is considerably enlarged; but the same outlines of mouldings are retained as are to be found in the original. The other parts of the cornice do not differ essentially from their prototype.

PLATE XV.

On this plate the cornice, architrave, and the base of the preceding plate, drawn on a large scale, are exhibited. The base is in the Grecian taste. Its upper torus is fluted; and the lower one is elliptical, and supposed to stand on a step. The student has already been advised of the importance of faithfully imitating the outline of Grecian mouldings.

PLATE XVI.

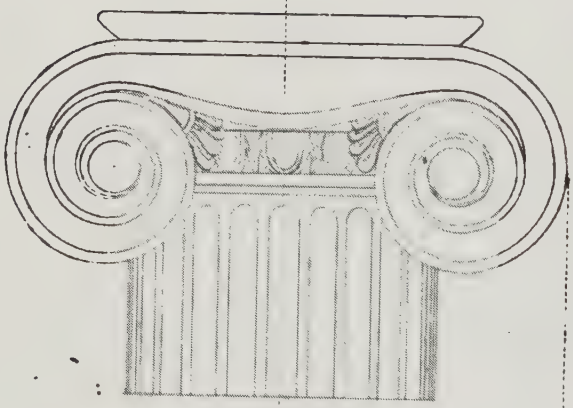
On this plate is exhibited a method of drawing the Ionic volute, particularly adapted to the two preceding capitals. At the distance

of two minutes from the shaft of the column, draw the vertical line *a* 6. On the point *o* as a centre, which is twenty minutes distant from *a*, describe the eye, giving it a diameter of seven minutes. At the distance of one and one fourth of a minute above and below the eye, draw lines at right angles with *a* 6; and at the distance of one and one half of a minute from 6 *a*, and parallel with 6 *a*, draw the line 10 11. This completes the outline of the square. Then, from the point *o*, draw diagonals to 10 and 11; divide *o* 10, and *o* 11, each into three equal parts, and from those points, and at right angles with 6 *a*, draw lines, cutting the diagonals at 2 6, and 3 7; and those points, together with the angles of the square, and 12, will be the twelve centres, from which the volute must be drawn.

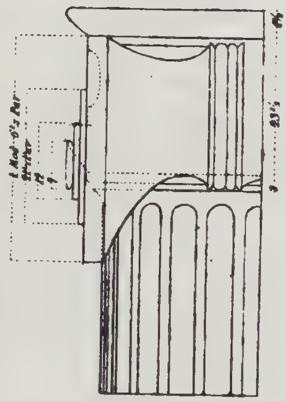
On 1 in the square, and with the radius 1 *c*, describe *c d*. On 2, and with the radius 2 *d*, describe *d e*. On 3, and with the radius 3 *e*, describe *e f*. On 4, and with the radius 4 *f*, describe *f g*. This completes one revolution. From 5, describe *g h*; on 6, describe *h i*; on 7, describe *i j*; on 8, describe *j k*; on 9, describe *k l*; on 10, describe *l m*; on 11, describe *m n*; and on 12, which, it must be observed, is one minute on the left hand side of the square, describe *n p*; which completes the outline of the volute. To draw the inside line of the fillet, divide its breadth into twelve parts, and make the fillet at *n* equal to eleven of them. Then make *m* equal to ten parts, and *l* equal to nine parts, and continue to diminish the fillet one twelfth at each quarter of a revolution, until it loses itself in a point at the upper extremity of the eye.

B exhibits the extreme outline of the fillet and eye of the volute, figured in minutes.

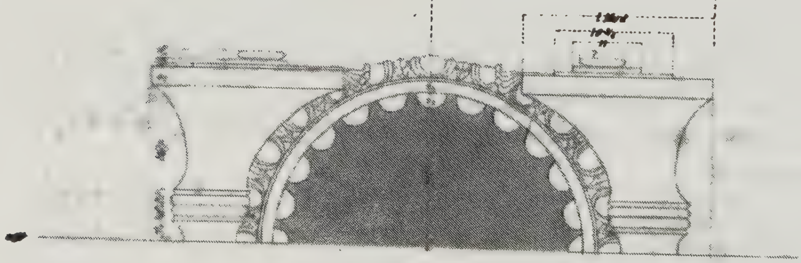
IONIC CAPITAL



Front Elevation



Side Elevation



Plan

PL. XVII

PLATE XVII.

On this plate is exhibited an inverted plan and a front and side elevation of the Ionic capital. Its different members are figured in minutes; and it is believed that these details will be clearly understood, without further explanation.

THE CORINTHIAN ORDER.

PLATE XVIII.

Before selecting and arranging the members, of which the example here exhibited is composed, the few remaining examples in Greece, and many fine ones in Rome, and also the drawings of this order by the most celebrated modern architects, were carefully and critically examined, with a view to select from them such of their details as were supposed to be best adapted to the composition of the order.

In the shaft of the column, less deviation is observed in the examples above alluded to, than in any other of its members. When the periphery of the shaft was divided into flutes and fillets, twenty-four of each was the constant number employed. In its altitude, greater deviation was visible. Vitruvius makes the shaft, excluding the capital, just equal to that of the Ionic. It however was sometimes made ten diameters in altitude, though it generally fell short of that height. In the capital, great deviations are also visible. Vitruvius limits its height to one diameter of the column; but it is in the best examples about seventy minutes, and this height is gene-

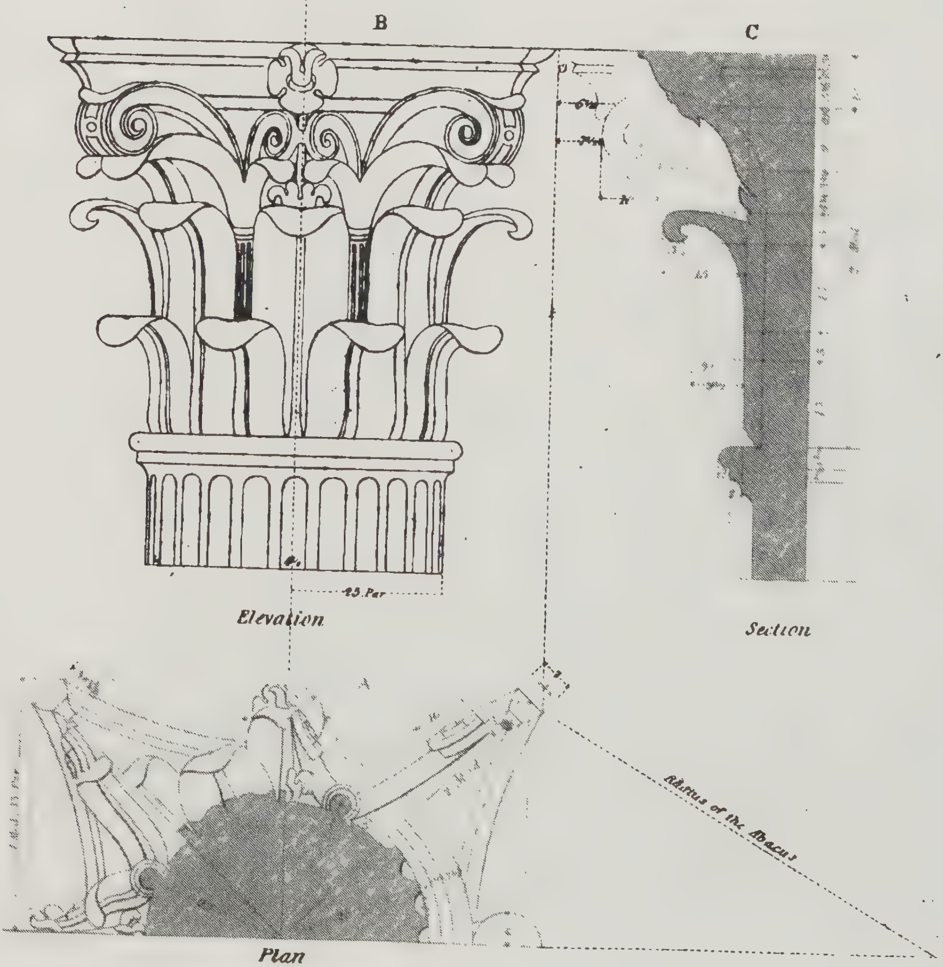
rally adopted in modern practice. In some of the ancient examples of this capital, the angles of the abacus extend beyond the volute, and terminate in an acute angle. This practice is not, however, mentioned here as being worthy of our imitation, but to be avoided. In the details of the sculpture of this capital, there does not appear to be any two examples which are exactly alike. It is therefore reasonable to suppose that the architects, after having arranged the general proportions, exercised their own fancy and judgment in filling up the smaller and less important parts. The capital here exhibited is in imitation, with some few trifling deviations, of that beautiful one left us by Andrew Palladio. Its fine graceful form, and the chasteness of its sculpture, render it most worthy of our imitation. The base is that known by the name of the attic base. When it has been rejected in this order, its substitute has generally been composed of a great variety and profusion of mouldings, many of which must consequently be small, and the effect of course confused and unstable. It is believed that the attic base, as here exhibited, approaches nearer to perfection than any other ; for in the mouldings of which it is composed, a peculiar fitness one to the other is observable, whether they be viewed in relation to their size or shape, which could hardly be found in any different form.

The entablature is two diameters and eight minutes in height, and similar to that of many others, though not an exact imitation of any one. The architrave is forty minutes in height, and divided into three fasciæ of nearly equal height. The first and second are divided by a rectangular projection, and the second and third by a bead. It is capped by a compound moulding, consisting of the echinus, with a bead below and a fillet above it.

The frieze is thirty-six minutes in height, and is left plain; but it was profusely ornamented in many of the ancient examples, the

Pl. 19.

CORINTHIAN CAPITAL.



character of which uniformly partook of that of the structure which they served to adorn.

The cornice is fifty-two minutes in height. Many difficulties must be encountered in composing and adjusting its members, caused principally by the great height and bulk of the bed-mould, when compared with those of the corona and crown moulding. Every cornice is divided into three parts: viz. the corona, which is the centre and principal member, and to which the other two are only subservient; the bed-mould, which is to support and strengthen the corona; and the crown moulding, which is to fortify and defend it from falling water. It is therefore wise to reduce the altitude of the bed-mould, as much as possible, without lessening too much the height of the mouldings therein contained, and to add so much to the height of the corona as to place it in its proper and honorable station as principal; and also to give so much height to the crown moulding, that it will appear sufficiently strong to fortify, strengthen and shelter its principal, the corona, without projecting so much as to cause the appearance of weakness and instability.

PLATE XIX.

This plate at A exhibits a plan of the capital inverted, showing the section of the flutes on the shaft of the column, and also a section of the leaves and stalks, and their projections from the body of the capital. The lower extremity of the projections of the leaves of the volutes and abacus is also shown. The circular outlines of the plan of the different faces to the abacus are drawn with a radius equal to the chord line of the whole extremity of the circle.

B exhibits a front elevation, on which the breadth and height of the leaves, volutes and abacus are clearly represented. C exhibits

a section on which the heights and projections of the leaves, scrolls and abacus are figured in minutes.

PLATE XX.

This plate exhibits all the members of which the entablature is composed, together with the base. They are all drawn to a large scale, and figured in minutes. In the cornice, is a front and side view of the modillion, and also its under surface, showing the particular form and outline of each of them.

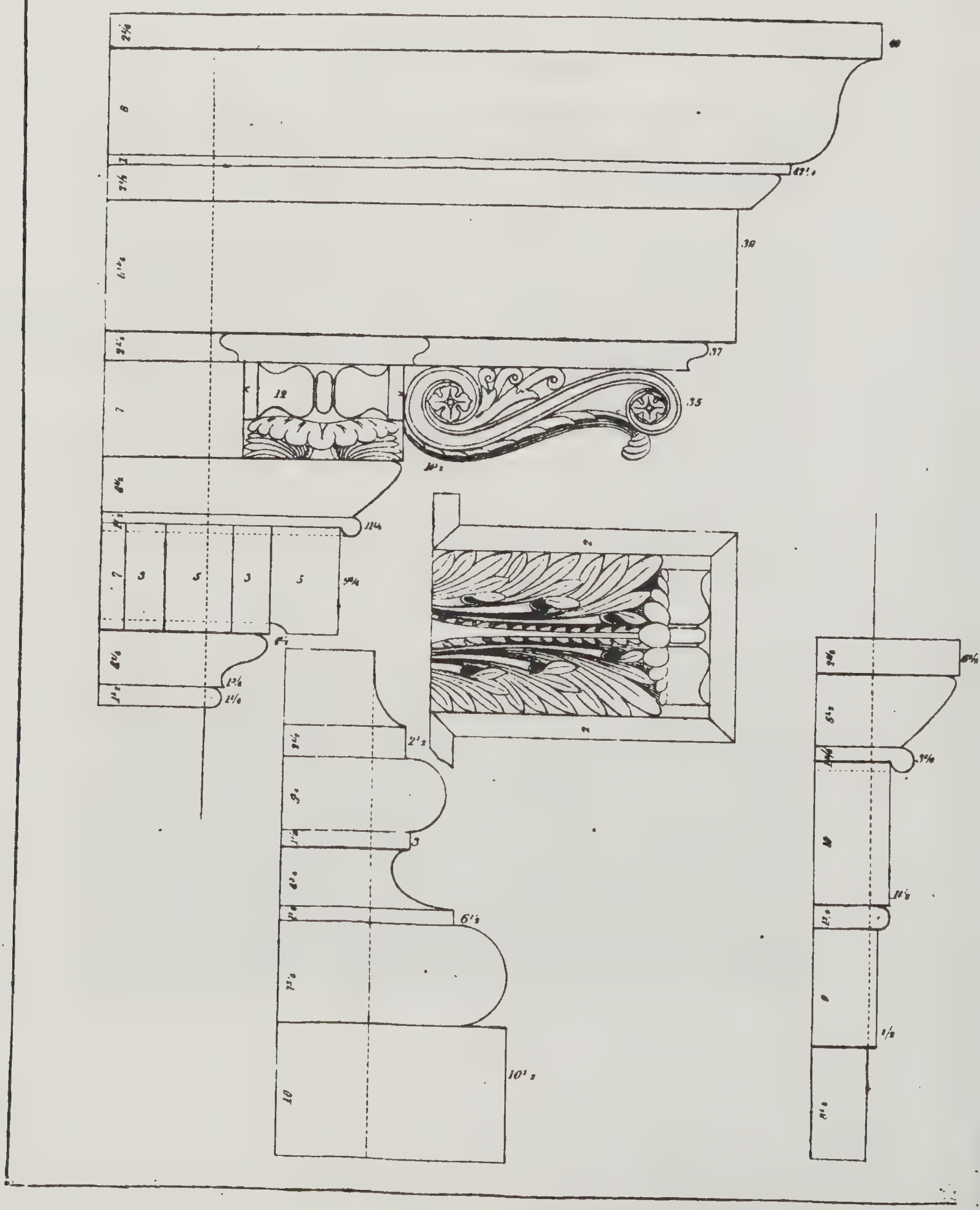
THE COMPOSITE ORDER.

PLATE XXI.

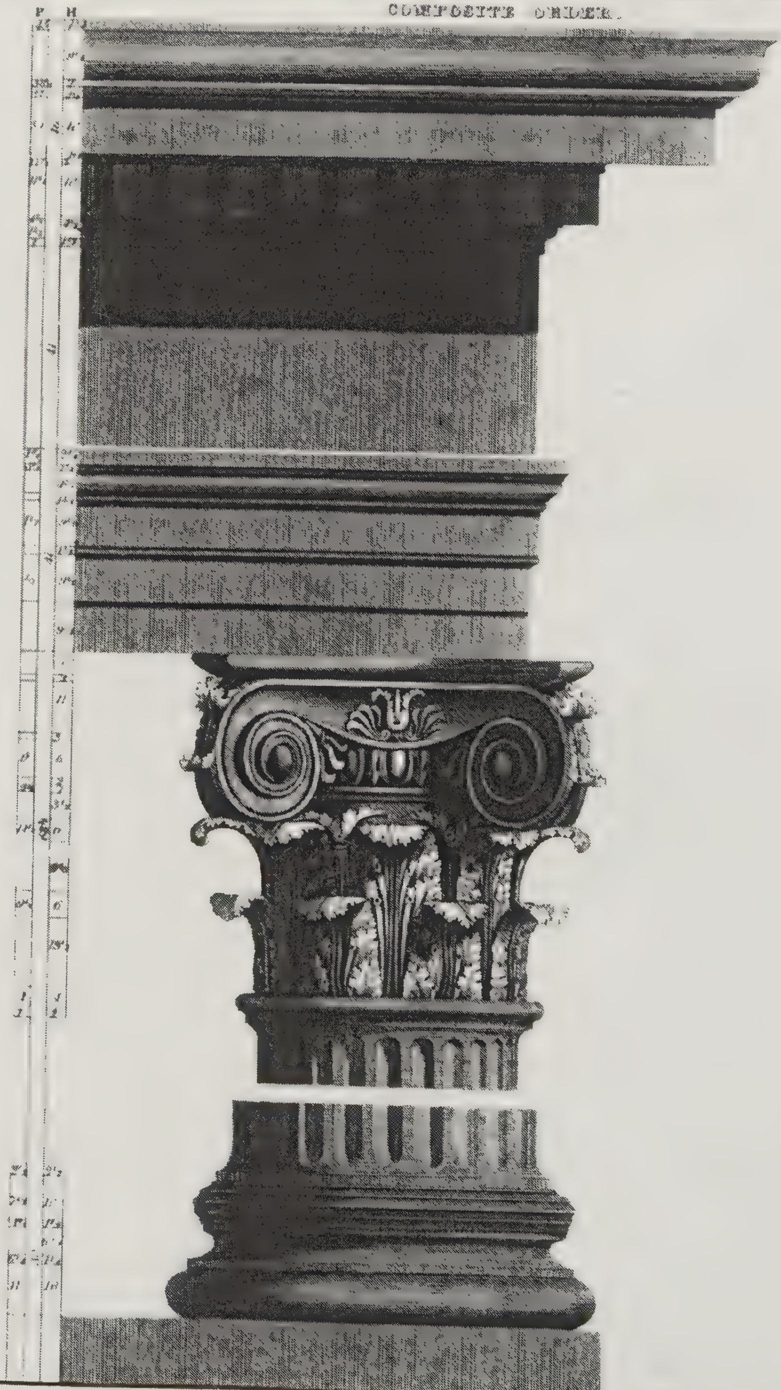
It has before been stated that this order is not now in public favor; nor does it appear to have been held in much estimation since the days of the Roman emperors. It nevertheless has had a place assigned to it in all, or nearly all, the practical books on architecture for the last century. This order was employed by the Romans in their triumphal arches, and in other similar structures. It was ornamented in the most profuse manner; every member, where propriety did not forbid it, being covered with the most costly and beautiful ornaments. It is, therefore, reasonable to suppose that it could not have been viewed with that impartiality with which it would have been, if dressed in plain attire; in which case the eye would, at a glance, comprehend the whole outline of the order, and

DETAILS OF THE CORINTHEAN ORDER.

Pl 20.



COMPOSITE ORDER. Pl. 21



immediately decide on its merits, instead of being, as it in fact was, so fascinated in viewing the great profusion of the most costly and elegant enrichments, as to overlook the general outline of the composition. Believing these views to be correct, and that this order ought either to be left out, or in some way to be revised and modernized, I have been induced to examine in the most critical manner all the examples in my possession; and the result has been a determination to try my skill on its reform. How well I have succeeded, it is not my part to decide. Had it been one of the established orders, I should have shrunk from the task; but as this composition is denied the name and rank of an order by many of our most eminent modern architects, it is thought to be a fit subject to work upon. The shaft of the column does not require any alteration from that found in the ancient examples of this order, it being there a close imitation of the Corinthian shaft, as described in the explanation of that order.

The base of the column has been left off, because it was generally the same in character and effect as that which adorned the Corinthian column. The one here substituted is in the Grecian style, inasmuch as the upper torus is fluted, in imitation of many of the best examples of Grecian bases; and the lower torus terminates, and is supposed to stand, on a step without an intervening plinth.

The lower Corinthian part of the capital is in exact imitation of that found on the arch of Septimus Severus at Rome: but in the upper, or Ionic part, there are many deviations; such as the dropping of the echinus and bead lower down, the effect of which is to reduce the plain, naked and awkward space, left between those mouldings and the termination of the long leaves, and to make a union between the upper and lower parts of the capital, so as to give it the appearance of one piece of composition. Before this

deviation took place, there was a complete separation between the upper and lower parts of the capital.

Again, in each face of the upper part of the capital, the stiff awkward form of the Roman Ionic capital has given place to the graceful Grecian. The latter change cannot fail to be approved by all those who are judges of this art.

In the cornice, the modillion, which generally made one pretty large member of the bed-mould, has been left off, and a dentil substituted in its place. In this procedure, the cornice of the example, from which the leaves of the capital were taken, has been imitated; but in no other respect can I claim protection for that, or any other example of that order.

I have endeavored to give to this composition a more systematic arrangement, than that which it has heretofore possessed. It has already been stated, in describing the origin of this order, that it was borrowed from the Corinthian and Ionic; that, from the upper extremity of the long leaves, down to the termination of the base, it was Corinthian; that the upper part of the capital was Ionic, and the entablature a mixture of both orders.

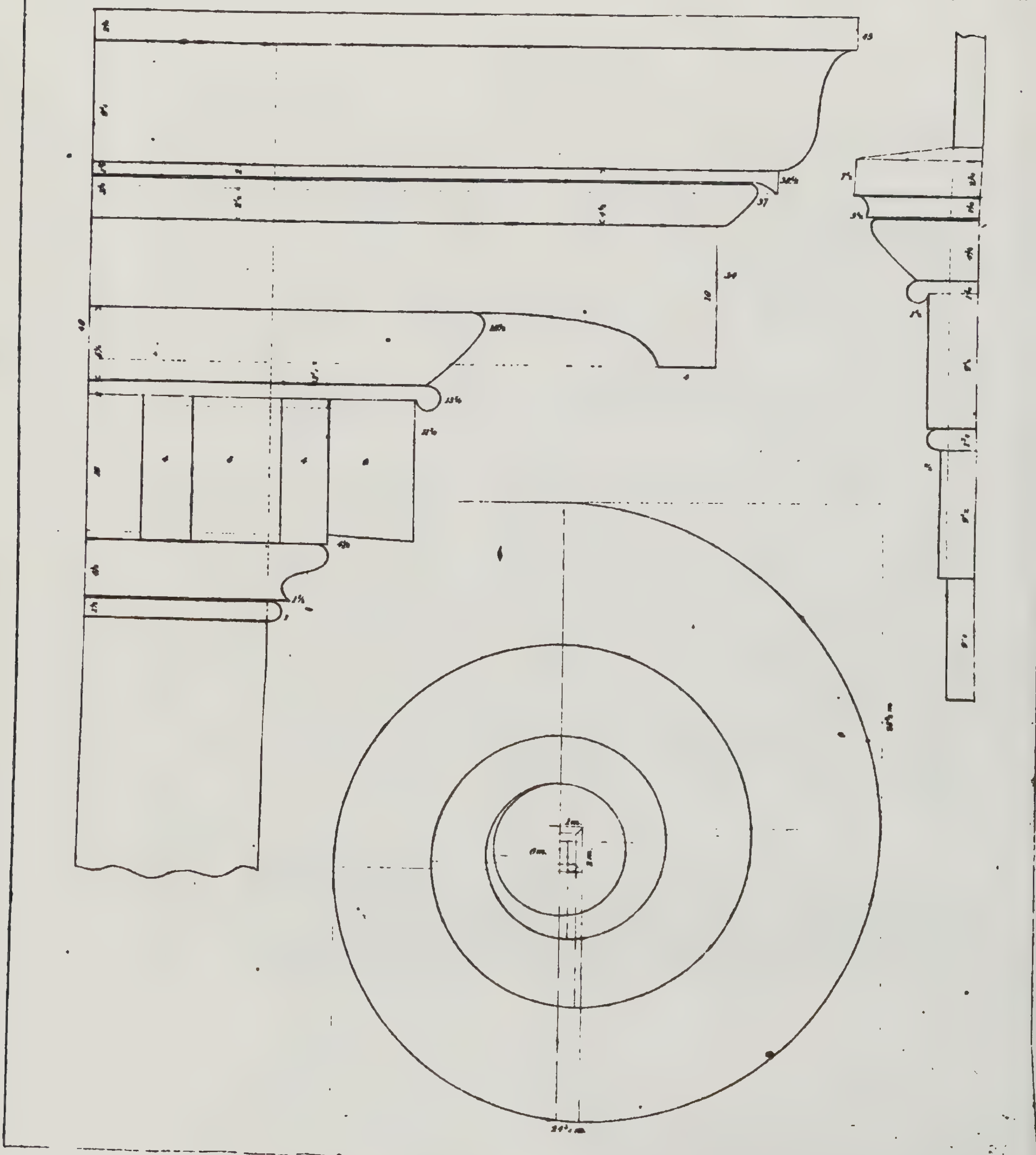
The only difference in expense, between this composition and the Ionic, is, then, that of the leaves, which form the lower part of the capital. As now modernized and reformed, it will probably in many situations be found worthy of imitation.

PLATE XXII.

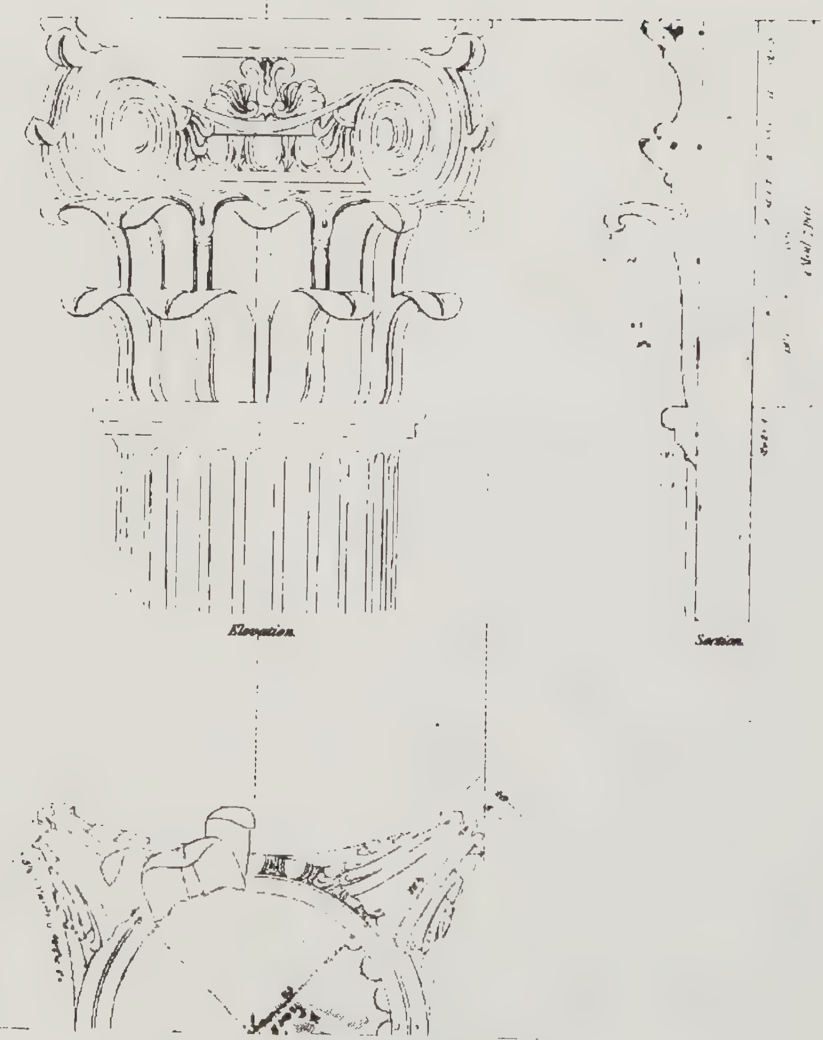
On this plate are the base, the architrave, and the cornice, all carefully drawn on a large scale and figured in minutes.

The volute of this capital is much smaller than that of the Ionic; and it therefore became necessary to give a rule for describing the

DETAILS OF THE COMPOSITE ORDER. Pl. 33.



COMPOSITE CAPITAL.



Elevation.

Section.

Plan.

outline of one adapted to this example. The vertical height of the volute is twenty-eight and one half minutes, and its breadth twenty-four and three fourth minutes. The eye is six minutes in diameter; and the square within the eye, where are to be seen all the centres on which the outline is described, is two minutes in height and one in breadth. In all the other particulars, the directions given for drawing the Ionic volute will apply here.

PLATE XXIII.

On this plate is exhibited an inverted plan of the Composite capital, and also a front elevation and section of it. Care has been taken with the drawings that they should be correct, and their different members be figured in minutes.

PEDESTALS.

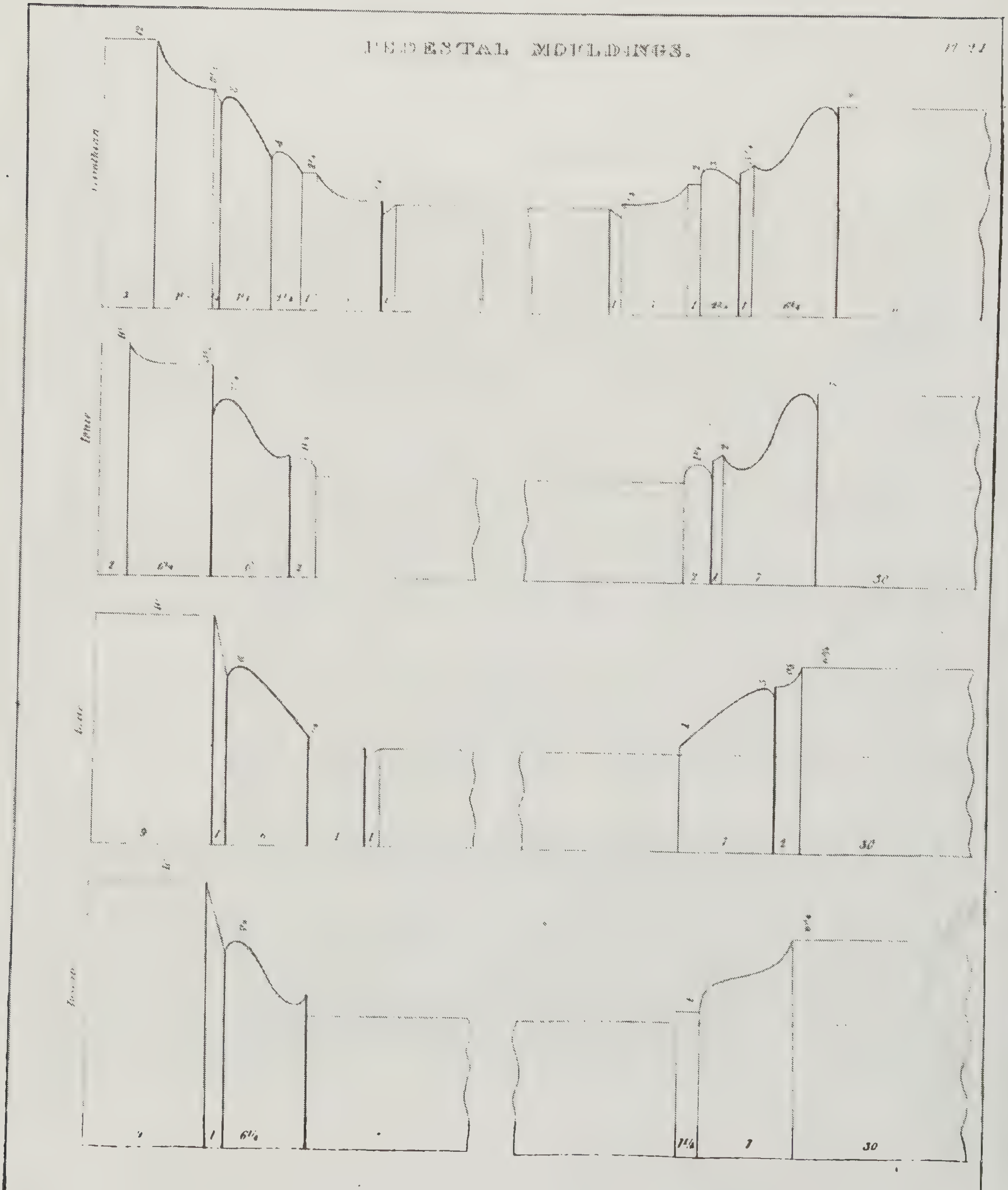
Pedestals have been considered and treated as a part of an order by most of the authors who have published practical books on this subject, from Palladio down to the present time. They seem properly to belong to the Roman system of the orders; for, in that practice, the columns, which served to support and adorn the superb Roman Temples, were based on a continued pedestal, which extended a sufficient distance front of each portico to permit the steps ascending into the Temple to terminate against its sides. In those cases, the floor of the portico was in the same plane with

the upper extremity of the pedestal. Nor was this the only situation in which the Romans employed pedestals. They were used by them in the second and third orders, when placed one over the other, as in the Coliseum, the Theatre of Marcellus, &c. The pedestal was also employed in their triumphal arches, and in several other places. It seems, indeed, to have been quite a favorite with that renowned people ; whence those architects who, having never seen the Grecian antiquities, had drawn their information from those of Rome, naturally imitated the Roman practice by adapting the pedestal to their times and circumstances.

But those who have lived in later times, and had the advantage of studying, not only the antiquities of Rome, but also those of Greece, have very generally adopted the Grecian practice, in which but few pedestals are found. The columns which adorned their magnificent temples, always stood upon the uppermost of three steps, which extended all around the buildings, each step being in height proportioned to the size of the building, and not, as in common stairs, to the human step. There is not, I believe, a single instance, where the Greeks employed columns over columns on the exterior of any of their temples. They, therefore, had no use for pedestals. There are, however, a very few instances, in which pedestals were employed ; such as in the Choragic Monument of Lysicrates at Athens, and also at one wing of the Erictheas, &c. : but these instances were innovations, which took place subsequently to the loss of Grecian independence.

It cannot, therefore, be supposed that the pedestal will be held in very high estimation by those who adopt the Grecian system of the orders. Nevertheless, there will arise, in practice, situations where the pedestal will be not only proper, but absolutely necessary.

PEDESTAL MOULDINGS.



The proportion of the pedestal to the order which it supports has not been determined. Sir William Chambers proposes three tenths of the height of the order for that of the pedestal. He then divides the height of the pedestal into nine parts; one of which he gives to the cornice, two to the base, and six to the dye. It is, however, generally admitted, that no determinate rule can be given, which will suit all situations where the pedestal may be required. It must, therefore, be left to him who sees and knows all the circumstances of the case, to give to it such a proportion as seems to him best suited to the occasion.

When pedestals are employed in balustrades over an order of columns, the dye should be, in breadth, equal to the thickness of the column at its neck; and in height, equal to that of the entablature on which it stands. A pedestal should be placed exactly over each column and pilaster in the facade. The plinth of the pedestal must be placed vertically over the frieze of the entablature.

When pedestals are employed for the support of columns, the breadth of the dye must be equal to the diameter of the base of the column; and the height, generally from two diameters fifteen minutes to two diameters forty-five minutes.

PLATE XXIV.

On this plate are examples of the bases and cornices to four different pedestals. Care has been taken, in selecting their details, that they should harmonize with the orders with which they are respectively associated. The base and cornice, selected for the Ionic order, are in imitation of fragments of ornamented mouldings found in the area of the Temple of Rhamnus; and those for the

Corinthian order, of the base and cornice of a tomb found at Carpuseli, in Asia Minor. Both examples are singularly beautiful in arrangement and effect.

INTERCOLUMNIATIONS.

INTERCOLUMNIATIONS form a great and distinguished division among the elements of Architecture. In this division are comprised the various modes of adjusting the distances between columns, determined by laws founded on reason, and looking to strength and beauty. Thus the distances of columns from each other are not determined by chance, nor by the caprice of one ignorant of this art; but according to the rules of proportion, guided by knowledge, discretion, and a refined taste.

Porticoes, or colonnades, among the ancients were classed under the following names, or styles.

The first style is called Pycnostyle, or columns thickly set; and the distance from one column to another in this style is one diameter and a half. The second style is called Systyle; and the distance between the columns is two diameters. The third style is called Diastyle; and the distance between the columns is three diameters. The fourth style is called Aræostyle; and the columns are four diameters from each other. The fifth and last style is called Eustyle; and the columns are two and one quarter diameters distant from each other. The latter style is said by Vitruvius to be the most pleasing of them all for general use. Besides these styles

of intercolumniations, porticoes likewise take their names from the number of columns of which they are composed. Having four columns, they are called Tetrastyle ; six columns, Hexastyle ; eight columns, Octastyle ; and ten columns, Decastyle.

Among the ancients, the distribution of the columns of their splendid temples was governed by rules, which were at once easy of application and sure of accomplishing the desired effect ; for, the size and relative position of the columns being first determined, the building of which they made a part was then in most respects made subservient to it. Thus it appears, that, after the extent of the front, the number of columns to be employed, and the order to be imitated, had been determined, the whole of the extent of the front was divided into a number of equal parts, depending on the order and number of columns to be employed, and then one or more of those parts, according to the intended intercolumniation, taken for the diameter of the column. The height of the column and that of the entablature resting upon it were settled according to the order to which they belonged. Thus the facade of the building was formed according to the most rigid rules. The extent of its depth was determined by making the number of columns in the flank equal to one more than twice the number of those in front, counting the angular ones on both front and flank. So much for the practice of the ancients, which was easy and direct. But however much we may desire to imitate this practice, we seldom or never can have that pleasure. Our buildings, whether large or small, one, two, three, or four stories in height, generally have their several apartments conveniently and economically distributed, and provided with a sufficient quantity of light, admitted by one, two, or more windows, of a suitable size for that purpose. These circumstances, to the architect desirous of following as much as possible the ancient rules,

are jarring elements; and he finds it a serious business so to adjust them with the proportions and distance of the columns, as to produce a perfect harmony throughout the whole composition.

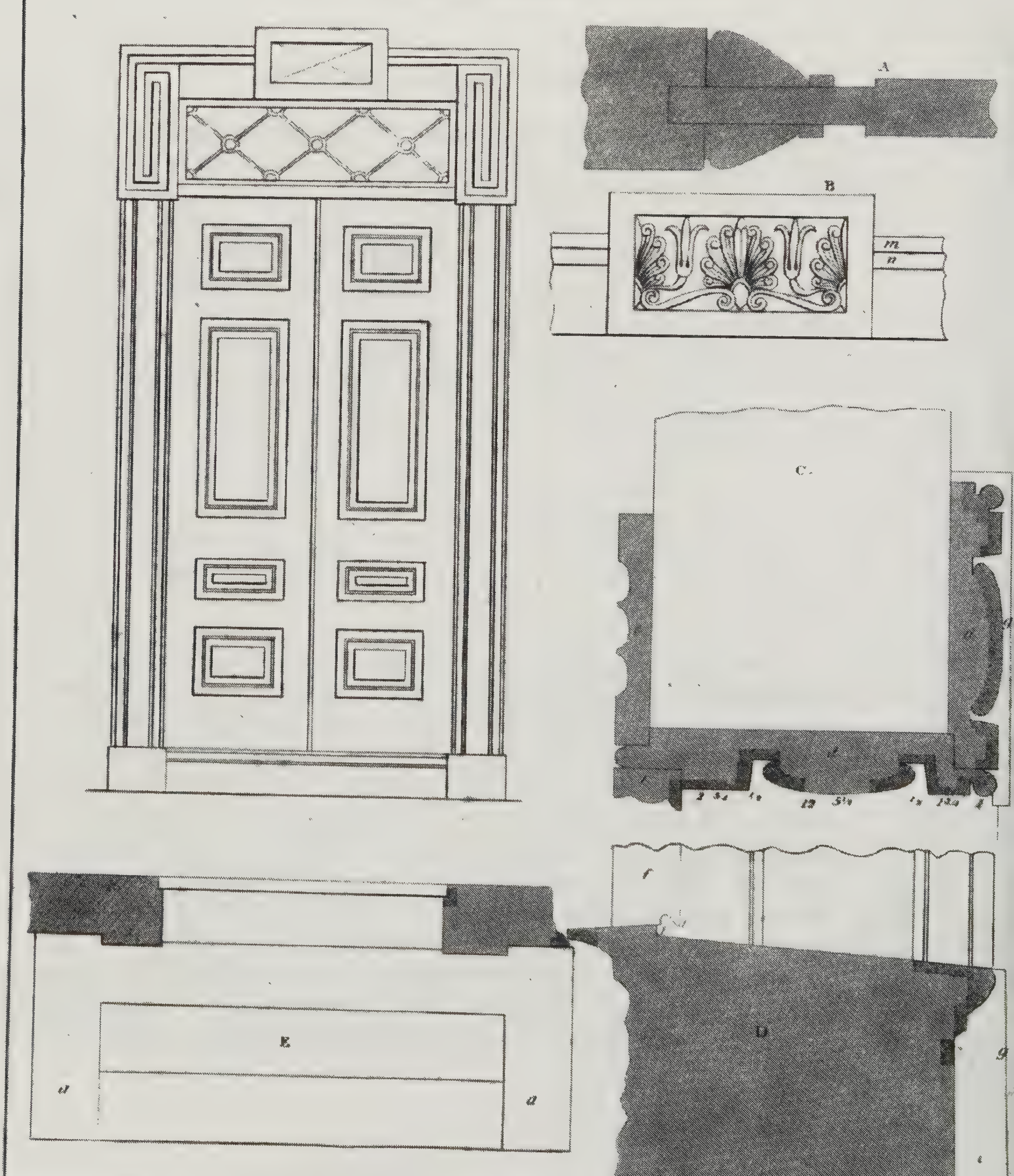
It sometimes happens that one order of columns is employed over another. When they are so employed, the stronger should be made to support the weaker; that is to say, the Tuscan order should support the Doric, and the Doric the Ionic, and so on. Stability also requires that the axis of the upper and lower columns should be in one vertical line. The diameter at the base of the upper column should be equal to the diameter of the lower one at its neck.

FRONTISPIECES AND PORTICOES.

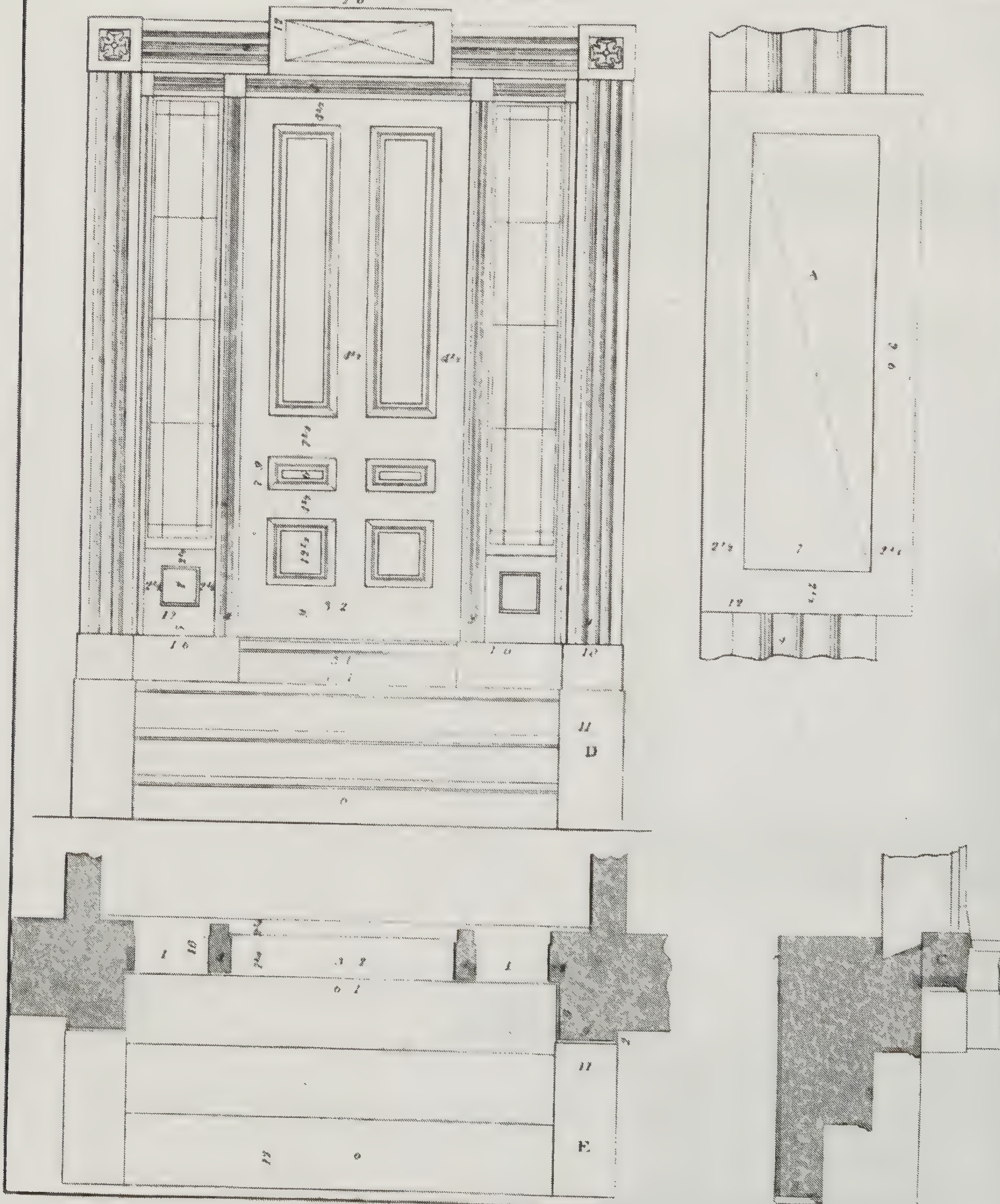
In some specimens of this important portion of architecture, one frequently discovers a strange fancy, exhibited in the unmeaning cuttings, carvings and twistings of the details, and their frequent breaks over columns, pilasters, tablets, &c., which renders their appearance quite ridiculous to a well-tutored eye. We frequently see a failure, likewise, in the general proportion of their outlines; such as a disproportionate quantity of glass over and at the sides of the door. It should be remembered that the door is the principal, and the windows are subordinate. The side and fan lights should not, therefore, occupy a larger space than is necessary to admit a sufficient quantity of light into the entry; and where a door is accompanied by side lights, and a fan light extending over both door and side lights, the outline of its upper extremity should be a segment

Pl 23

FRONTISPIECE



FRONTISPIECE



of a circle, and not a straight line. In the latter case, the distance from the upper extremity of the division which separates the door from the fan lights to its top edge, will be so great as to produce the appearance of instability; which appearance, by the use of a curved line bounded by an arch, is wholly avoided. But where the fan light extends over the door only, a straight line, for its upper extremity, is preferable to any other.

In adjusting columns, pilasters, architraves, &c. to this species of architecture, nothing will direct the judgment of the student so unerringly as the often-repeated maxim of proportioning the means to the end. Let him therefore bear in mind the extent, situation and character of the building, of which his frontispiece or portico is to make a part, together with the size and decorations of all their elements, as well as the burden which the columns or pilasters to be employed have really or apparently to sustain; and, if he possesses a good knowledge of the art, the result of his labors will probably be successful.

PLATE XXV.

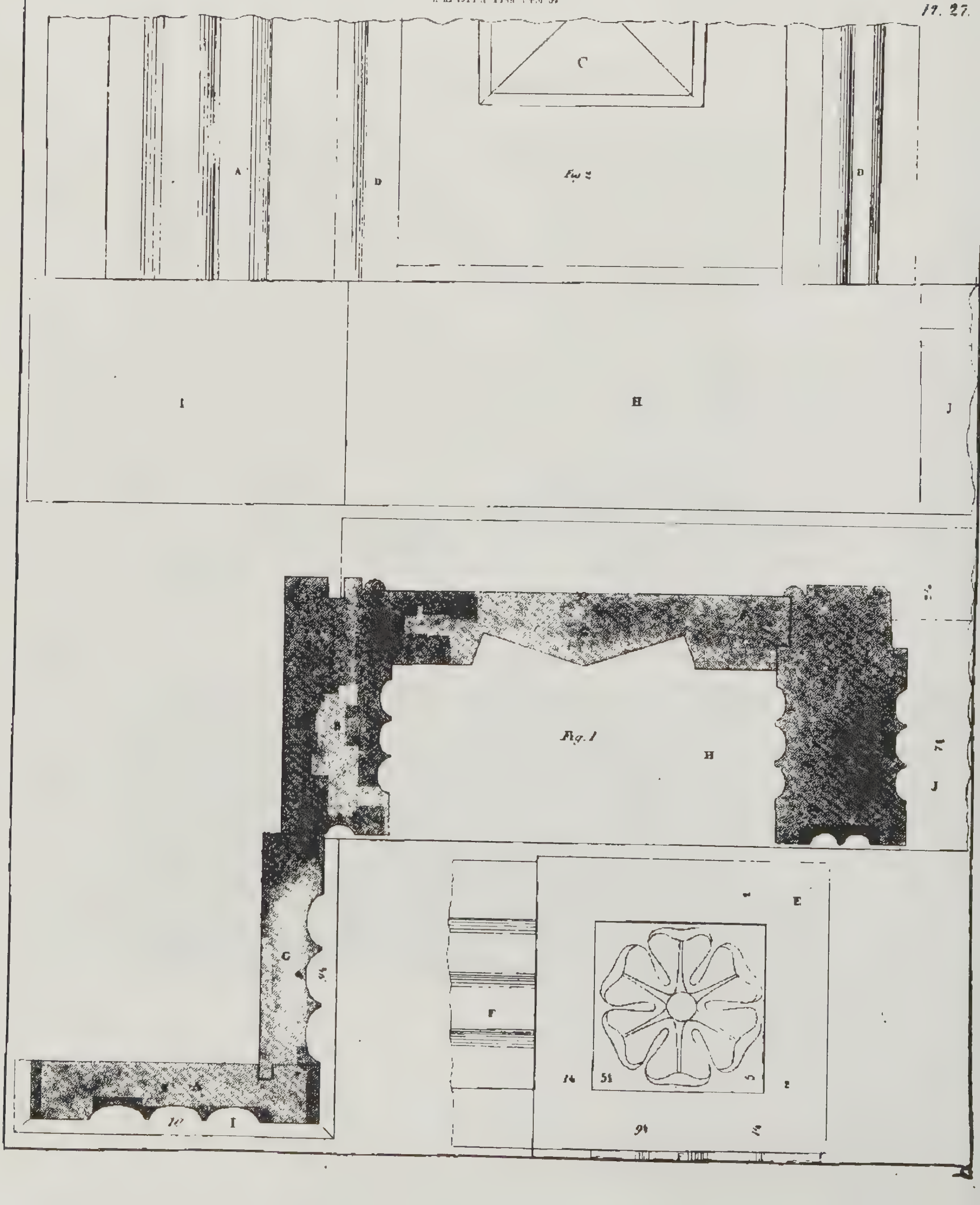
The example of a frontispiece exhibited here, is suitably constructed for the front of a house of pretty large dimensions. The door is divided in the centre by a vertical line, one half of which will be sufficiently large for the ingress and egress of one person. The advantage gained by this practice is very important in boisterous situations, as it will admit but one half as much cold air when opened, as it would were the whole door opened at once.

This example, together with the preceding ones, are drawn from a scale of one half of an inch to one foot. All their details can, therefore, be accurately measured. This door is four feet two

inches in width, and eight feet in height. The width of the narrow rails is four inches and five eighths. That of the bottom rail is nine inches, and that of the middle one seven and three fourth inches. The height of the lower panel is twelve inches; of the small middle one, seven and one half inches; and of the upper or frieze panel, nine inches.

A exhibits sections of a part of the style and panel of the door, and of the mouldings, drawn one half of the full size. B exhibits an example for a tablet, decorated with sculpture, which may be substituted for that in the elevation, when a more ornamented one is desired. The tablet is drawn from a scale of one inch to a foot. *m* and *n* represent the fillets which butt against the tablets. They continue round and form the fret. C exhibits a section of the pilasters, as they are connected with the door and wall of the building, drawn from a scale of one fourth of an inch to one foot. *d* and *d* show the sections of both front and side of the pilaster. To proportion the mouldings to the pilaster, divide the breadth, which is here nine inches, into twelve equal parts; make the bead equal to one part; each of the fillets to one and three quarters; the deep recesses or fillets between the ellipsis and fillets, each equal to one half, and the ellipsis to five and one half parts. *s* represents a small portion of the section of the door, where it shuts into the rabate.

D exhibits a section of the threshold; *g*, the front line of the plinth on which the pilaster rests; *f*, a vertical section of the lower extremity of the door, extending nearly half of its thickness front of the rabate on the threshold; and *i j*, a channel on the under surface of the door, which is intended to prevent the rain, when forced by the wind against the door, from being driven between the door and threshold into the house. When this precaution is attended to, the rain will fall off on its arrival at *i*, down to the threshold, and descend to the steps.


C
A
D
Fig 2
D
I
H
J
Fig. 1
H
J
G
E
F

FRONTISPIECE. *Pl. 28.*

E shows a plan of the steps and threshold, and also a part of the wall on each side of the door. The elevation of these steps is not here represented. Their width is twelve, and their rise eight inches. The upper surface of the top step is in the same plane with that of the buttresses, which are represented at *a* and *a*. The buttresses will be three feet in length, two in height, and one foot thick. The distance between them will be equal to the united lengths of the threshold and the plinths.

PLATE XXVI.

The plan and elevation of the frontispiece here exhibited is suitable for a house of moderate size, or where the story is not sufficiently high to admit a fan light over it, or when a fan light is not desired. The frame of the door and side lights are recessed into the house seven inches. All the details of this example are figured in feet and inches. The tablet and the spaces between the side lights and the threshold are decorated with diamond panels. A represents the tablet, drawn on a scale of one and a half inch to one foot; C, a side view; D, the front elevation; E, the upper surface of the buttress, against which the ends of the steps terminate; and C exhibits a section of the threshold.

On Plate XXVII. are exhibited some of the working plans, drawn one quarter of the full size. A and G on fig. 1 represent a section, and A on fig. 2 an elevation, of the large pilaster; B and D on fig. 1 the sections, and D and D on fig. 2 the elevations, of the small pilasters. C on fig. 1 represents the section, and C on fig. 2 the elevation, of the diamond panel. I on fig. 1 represents the section,

and I on fig. 2 the elevation, of the plinth on which the pilaster rests; H on fig. 1 the upper surface, and H on fig. 2 the front view, of the threshold. J shows a front view of a small portion of the threshold, which extends under the door and is moulded on the front.

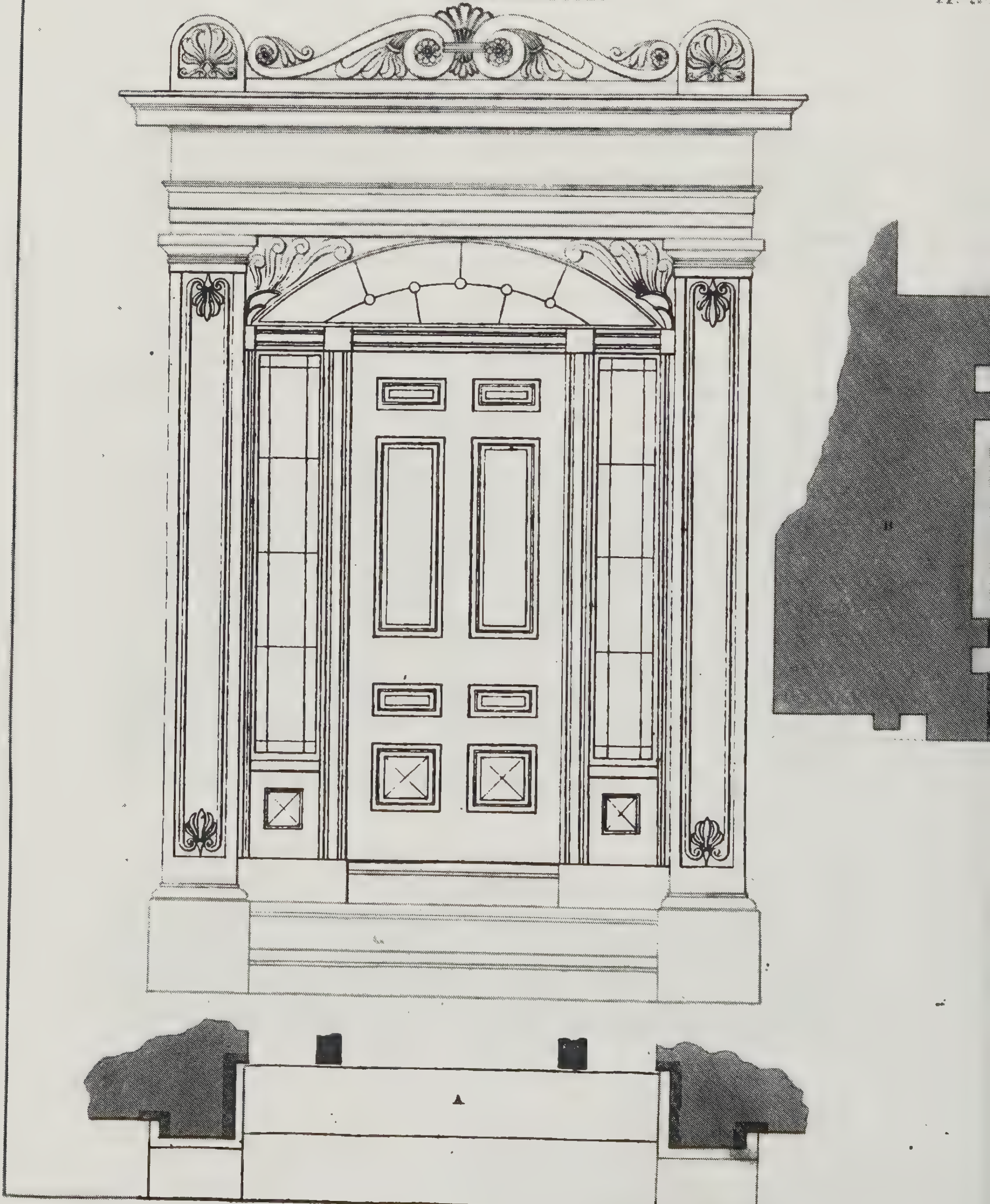
PLATE XXVIII.

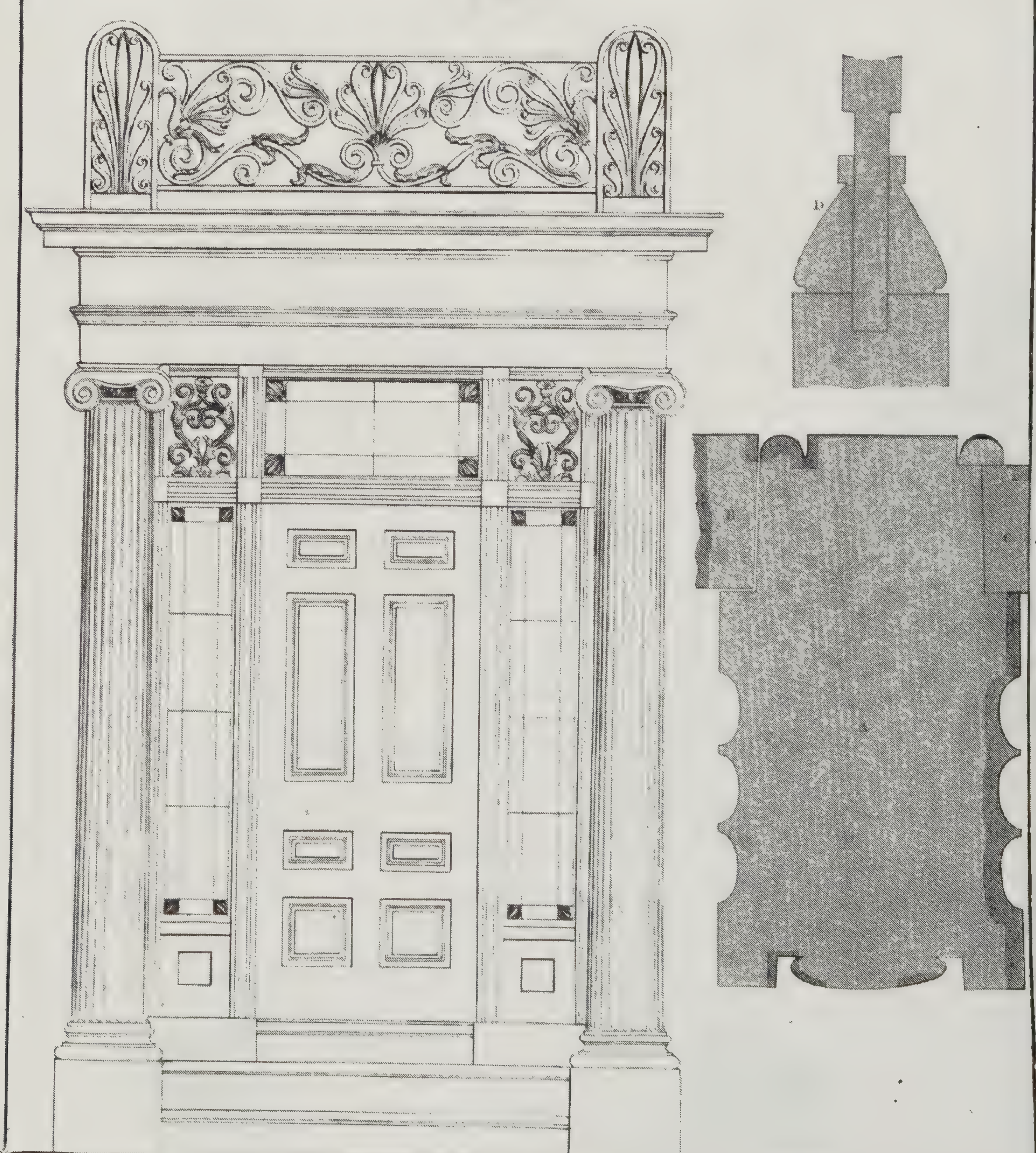
The example of a frontispiece here exhibited shows a fan light extending over the door and side lights, its upper edge bounded by a segment of a circle. The spandrels made by this curve, and by the angles of the pilaster and cap, are decorated by a plain honeysuckle, the dimensions of which in practice will be so large that they may be wrought by a carpenter when a carver is not at hand. The tablet and panels under the side lights are likewise decorated with sculpture; but should this be thought too expensive, plain panels may be substituted. A exhibits a side view of the pilaster and a section of the cap; B, a section of the steps and a part of the side elevation of the buttress; C, the tablet, drawn from a scale of one inch to a foot; and D, the plan of the buttress, steps and threshold, and also sections of the pilasters, plinths, &c. As all the essential parts of this example are figured in feet and inches, and as the explanation of the foregoing plates was so full, no further explanation will be required here.

PLATE XXIX.

The example of a frontispiece on this plate, is, in its door, side, and fan light, similar to the one last described, but differs very widely from that in its other decorations. The pilasters and entablature, in their proportions and the outline of their mouldings, are

FRONTISPIECE.





in imitation of the column and entablature on Plate VII., with the exception of the capital to the pilaster, which is taken from the Doric antæ capital. The panels which decorate the lower part of the door, and those under the side lights, are intended to be diamond panels. In other words, the panel is intended to project forwards in the centre to a right line with the stiles and rails, and from that point to incline on a straight line, and on each of its four sides, to the thickness of the other panels, at its termination against the groove which separates it from the mouldings. A exhibits a plan of the steps, showing the sections of the pilasters and the upper surface of the buttress.

B shows a section of one half of a pilaster, drawn to a scale of one quarter of the full size.

The sculpture which crowns the entablature, if thought to be too rich or too expensive, may be left off without affecting the symmetry of the composition.

PLATE XXX.

The example of an Ionic portico exhibited on this Plate, is in its general proportions, and the outline of its details, in imitation of the example of that order as represented on Plate XIV.

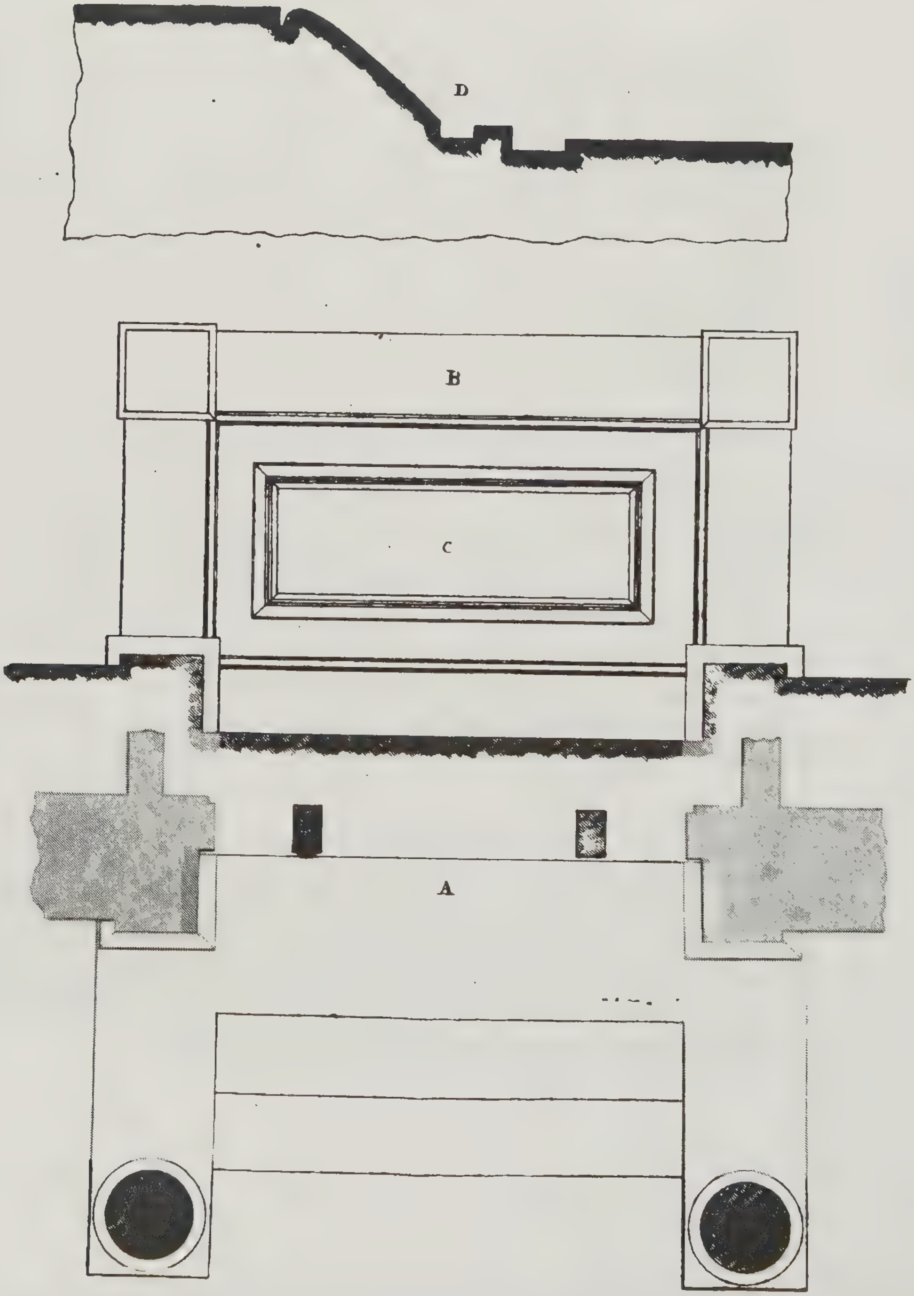
A similarity may be remarked in the size and construction of the doors and side lights of this and of all the preceding examples. This sameness I do not strive to avoid, from the belief that a great variety in the size and construction of these essential but subordinate portions of architecture, is not required by a correct taste, nor adapted to the place they occupy.

If decorations are desired on these windows, let them be made with a sparing hand, on stained glass, and of a proper size and figure; for the student must remember that it is a maxim in architecture, that the ornament must be made for the place, and not the place for the ornament. A practice has heretofore prevailed among designers and makers of side and fan lights, and is not yet quite extinct, of exerting their ingenuity in the contrivance of a great variety of crooked, winding outlines, which they applied to the formation of the internal divisions of these sashes; and their imagination was again taxed in contriving a great profusion of rosettes, stars, beads, &c. After the elements had thus been adjusted upon the sash bars, their surface was often adorned with gold leaf. These gorgeous windows are often seen in dwelling-houses of exceedingly plain exterior, and present a contrast quite ridiculous to a well-tutored eye. The sculpture over each side light should not project beyond the frame which encloses it. A exhibits a section of the pilaster which separates the door from the side light; C, a part of a section of the sash and bead; B, a part of that of the stile of the door; and D, a section of the mouldings, and a part of the stile and panel to the door. These sections are drawn one half of the full size.

PLATE XXXI.

A exhibits a plan of the steps, buttresses, columns and pilasters to the Ionic portico represented on the preceding plate; B, the under surface of the architrave; C, that of the panel enclosed by the architrave B, and recessed up just the width of the architrave; D, the moulding of the panel one half of the full size.

Pl. 31.



DESIGN FOR A COMPOSITE PORTICO.

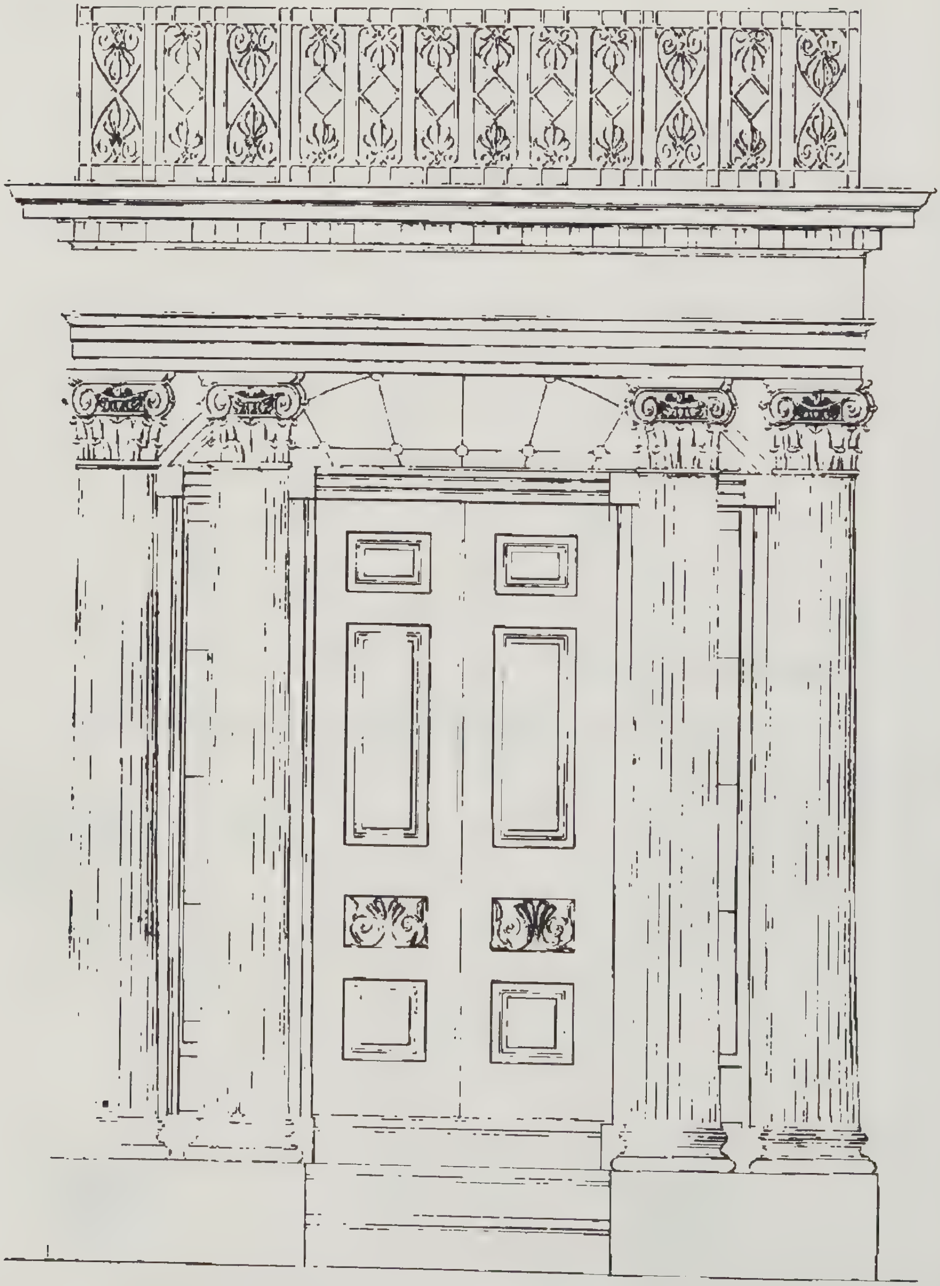


PLATE XXXII.

This Plate exhibits an example of a Composite Portico, having four columns in front. The proportions are in imitation of the example of that order as shown on Plate XXI.

Its character is rich, and its size sufficient for a building of large dimensions ; nor can it indeed with propriety be employed on a small building. It is surmounted with a railing intended to be made of cast iron, which may or may not be employed, as taste or convenience may dictate.

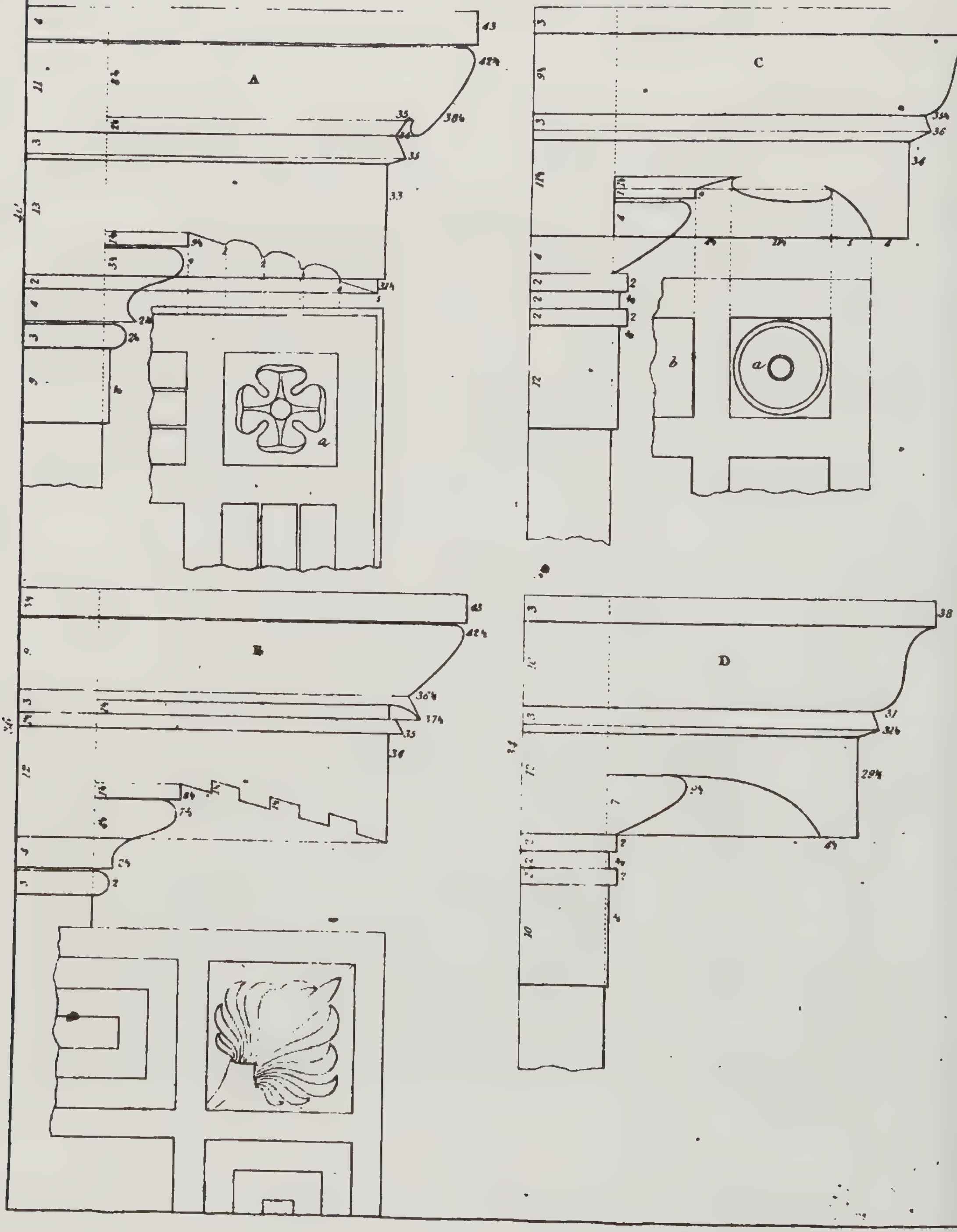
EXTERNAL AND INTERNAL CORNICES.

Cornices have heretofore been pretty fully treated of, as a distinguished member of each order. They nevertheless require further notice, as employed separate and distinct from the orders ; as they necessarily will be in various and important situations, such as the crowning and finishing under the eaves of all kinds of buildings, and in many other external situations. It is highly important that when so employed, they should conform to the character of the building which they decorate. Cornices are also used, in various internal situations ; such as in rooms, halls, staircases, &c. When so employed, they are generally made of stucco. But wherever used they will be considered subordinate, and must therefore be in keeping with the rest of the apartment.

Some architects have attempted to determine the size of a cornice, by making its virtual height equal to a certain portion of the whole height of the building, from its base to the upper termination of the cornice. But these attempts have not been, and in fact cannot be, carried into universal practice; for buildings of equal heights may have such different situations as to require cornices of unequal sizes. We will suppose, for instance, two buildings, one measuring twenty-five feet in front and the same number of feet in height, and the other the same in height but fifty feet in front. It is plain that the doors, and windows with their decorations, of the latter building, require to be somewhat larger than those of the former one. Of course the cornice of the latter must have a proportionate increase in size. We may however assist our judgment by the above rule. Divide, for instance, the altitude of the first-mentioned building into twenty equal parts. One of these parts will be fifteen inches, which will be a suitable height for the cornice of that building. But for the cornice of the second building, take one twenty-third of its height, or thirteen inches. Suppose each of the above described buildings extended to the height of forty feet. In that case, one thirtieth part of the height of the first, or sixteen inches, and one thirty-third of the latter, or fourteen and one half inches, would be a size suitable for their respective cornices.

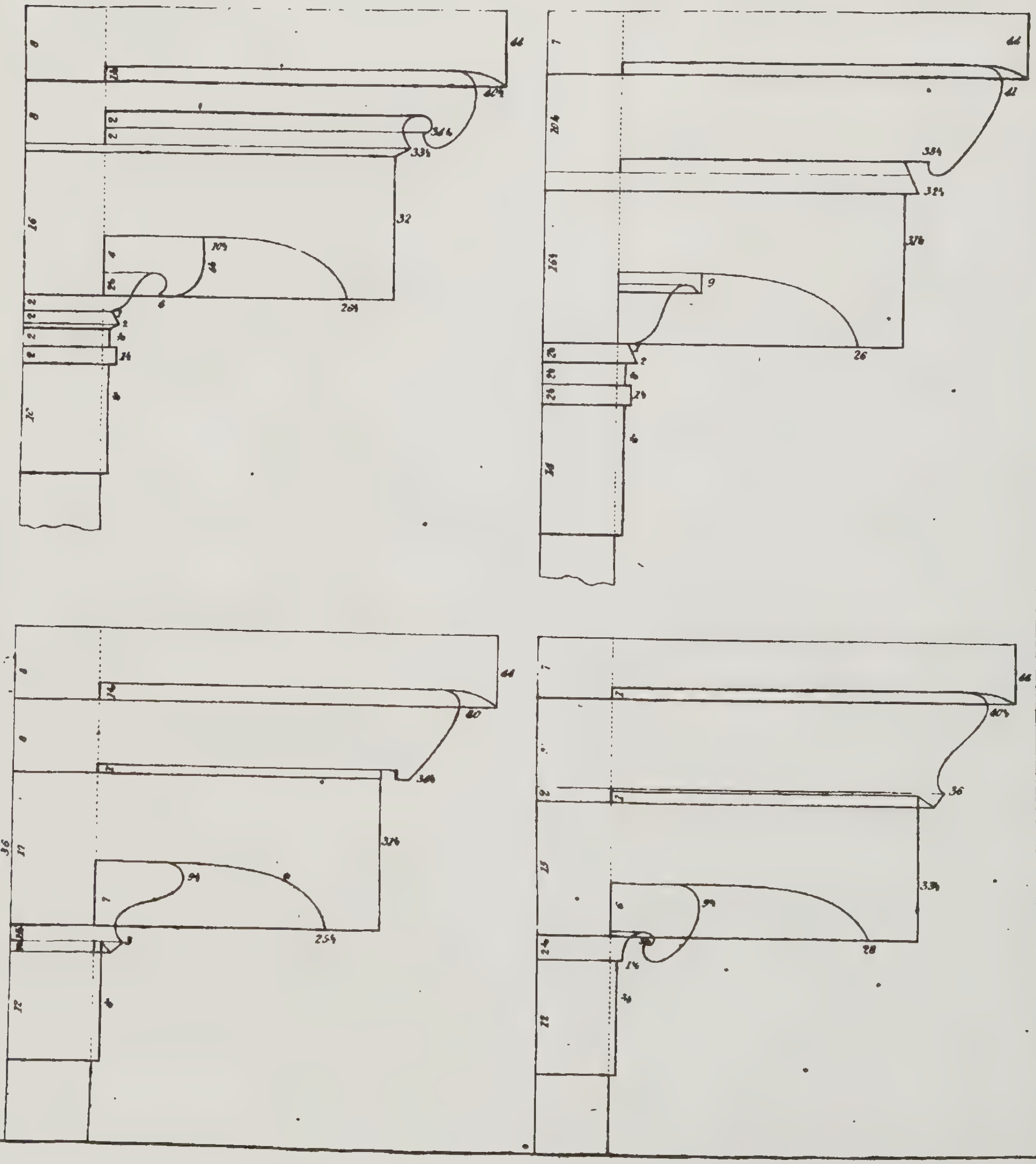
Internal cornices, as for rooms, staircases, and the like, differ in their construction very considerably from those already described. Their height is generally much less in proportion, and their projection much greater. This practice is both convenient and natural; because the cornice cannot be viewed at any great distance, and its height being only observed at such a short distance that the spectator is obliged to look up from under its projection, its front is never fairly seen. In low rooms, where the space from the upper

CORNICES. Pl.

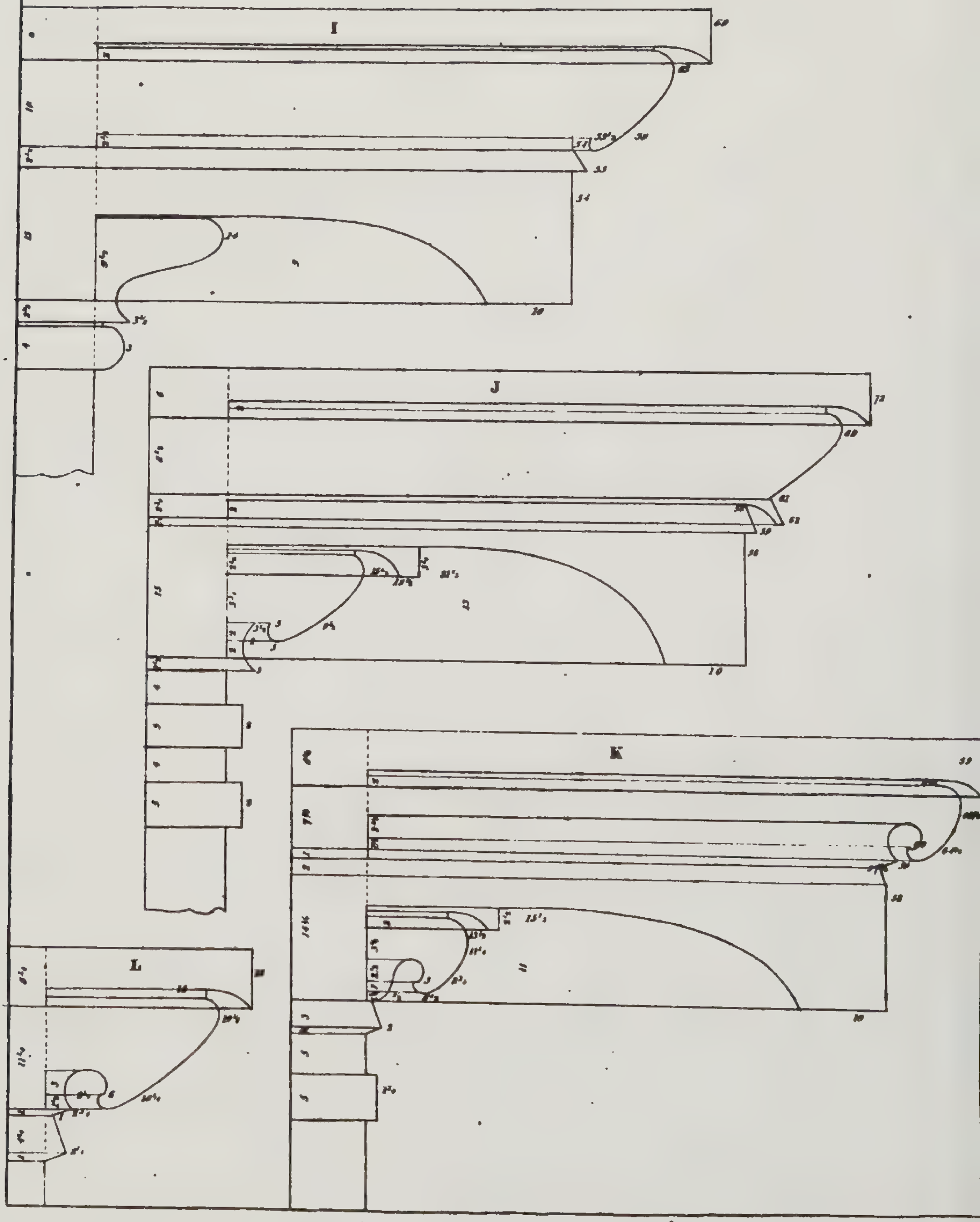


Pl. 34

CORNICES.



STUCCO CORNICES.



termination of the architrave to the window and the under surface of the ceiling is very small, it is sometimes expedient to confine the height of the cornice to a space not exceeding two inches ; and in this case it will be wise to increase its projection, so that its height and projection together shall be about equal to what they would have been if this expedient had not been resorted to. This great difference between the height and projection might at first thought be considered disagreeable ; it is, however, adapted to the peculiar situation of such a cornice, and much more pleasing than the usual proportion would be.

In adjusting the proportions of these cornices, the size and height of the rooms should be taken into consideration. If the ceiling be high and the other dimensions of the room small, the difference between the height and projection of the cornice should not be very great ; because in that case a large projection would reduce the size of the ceiling, and the whole room would appear smaller. But if the room be of large dimensions, and the ceiling high, the projection of the cornice may then be considerably more than its height. There is less difficulty in determining the size of these cornices by fixed rules, than of those employed externally ; because the difference in the heights of rooms where cornices are used, is not very great. A room less in height than ten feet is not often decorated with a cornice ; and it is not common to see a room more than fourteen feet in height. A method of adjusting the proportion of cornices to rooms, which gives much satisfaction, may be obtained by making the joint extent of the height and projection in inches equal to the height of the room in feet.

PLATE XXXIII.

This Plate exhibits four examples of cornices for external finishing. A has a sloping plancer, which is decorated with three elliptical flutes, terminating at the angles of the cornice against the fillets of the panel *a*, which is recessed up into the plancer and decorated with a rosette.

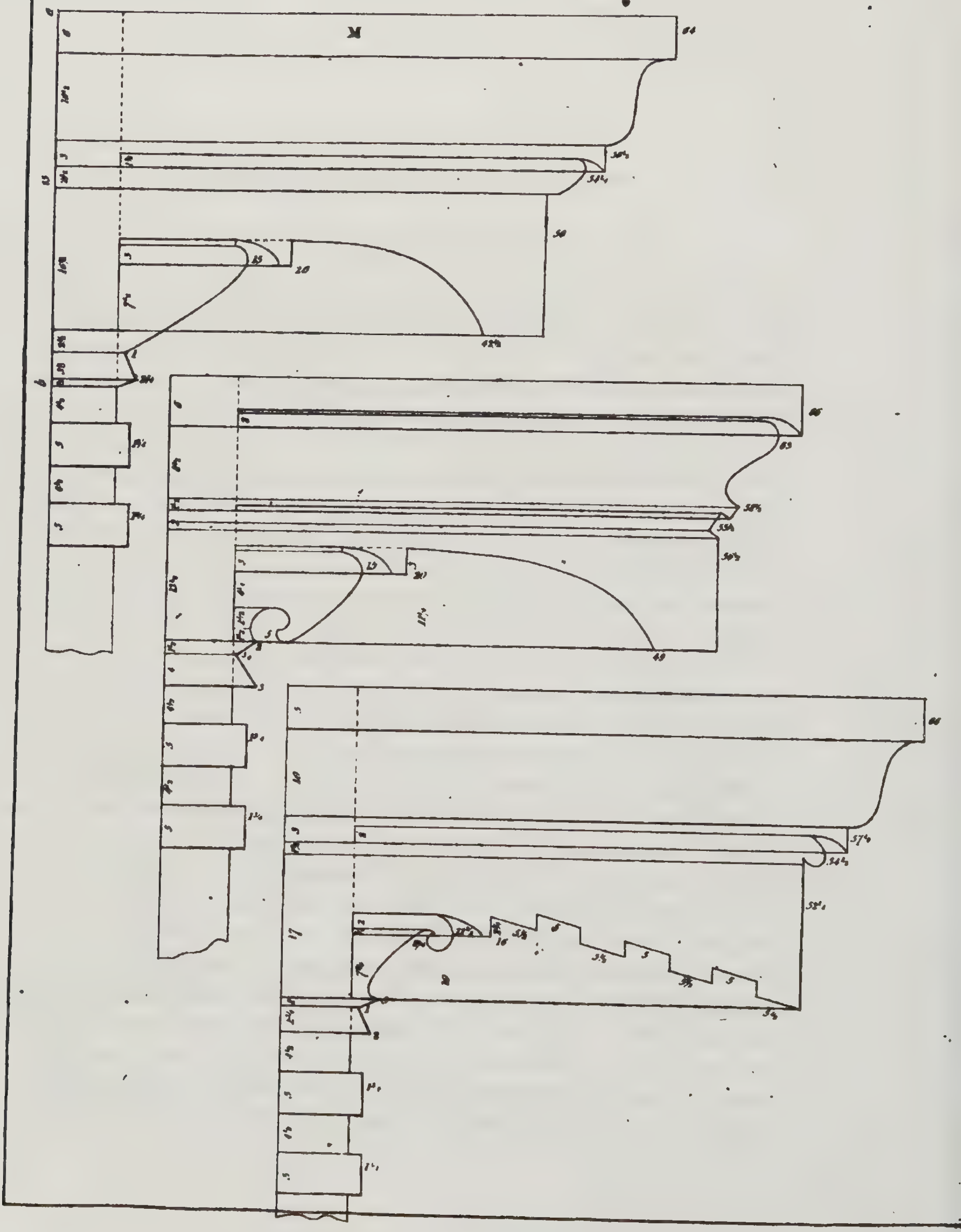
B has also a sloping plancer ; and it is decorated with three channels, or grooves, which terminate at the angles in the form of a fret. *b* shows a panel recessed up into the plancer, and decorated with a honeysuckle.

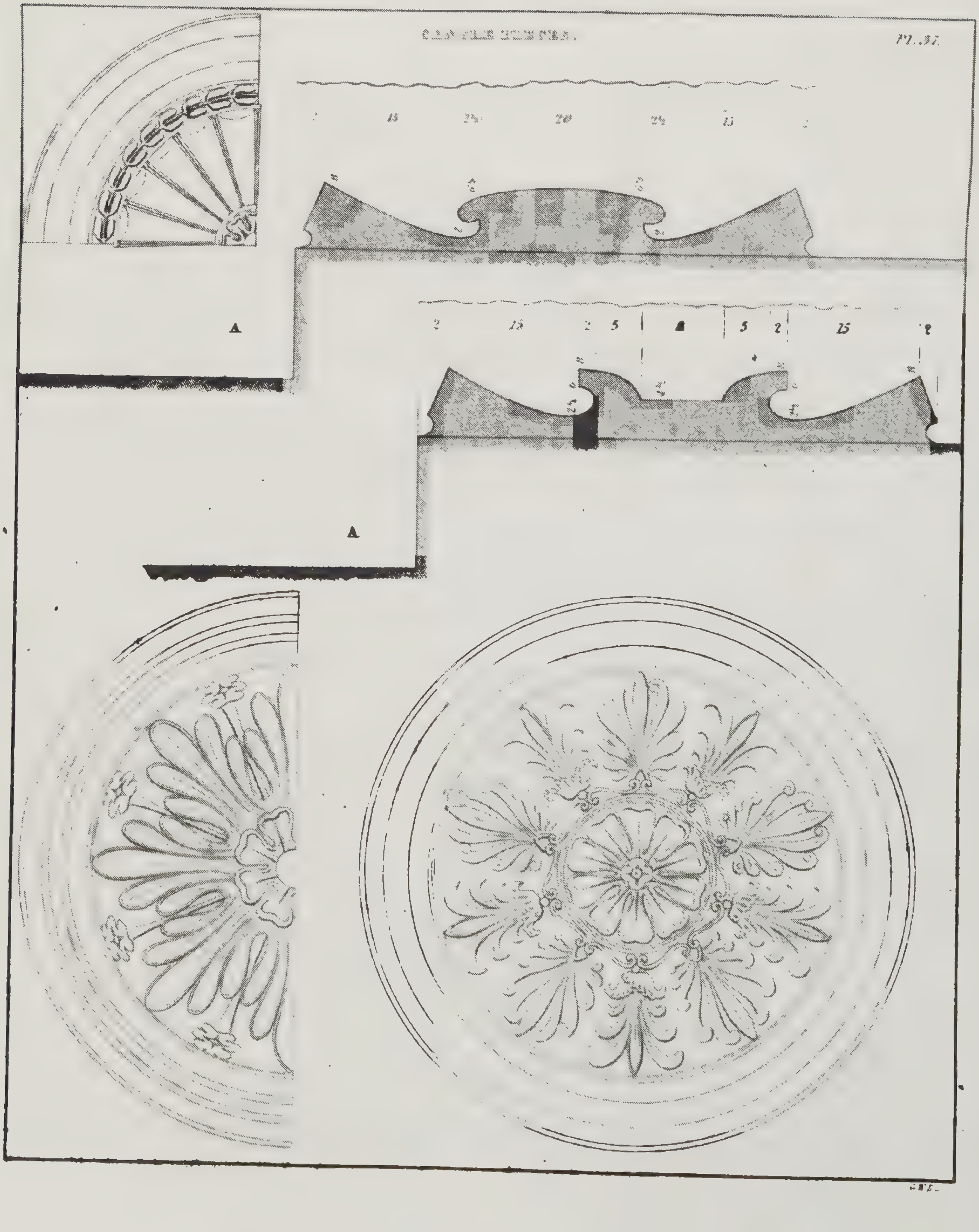
C exhibits an ellipsis recessed up into a reverse curve in the plancer. The inverted plan of the plancer shows the finish at the angles. *a* shows a panel, and *b* the ellipsis.

D exhibits an example of a plain bold cornice, which will produce a pleasing effect in practice. On Plate XXXIV. are exhibited four examples of cornices, which do not seem to require any other explanation than an examination of the Plate will give.

On Plate XXXV. are exhibited four, and on Plate XXXVI. three different examples of cornices suitable for internal finishing. A rule for determining their size has already been described, which gives for each foot in the height of the room, one inch to the height and projection of the cornice. We will suppose in practice a room ten feet in altitude, and the cornice M, on Plate XXXVII. to be selected for use. That cornice is forty-five parts in height, and projects sixty-four parts, which added together make one hundred and nine parts. Ten inches, or one inch to each foot in the height of the room, must therefore be divided into one hundred and nine equal parts. Then each member of the cornice, both in height and projection, is equal to as many of those parts as are figured thereon.

STUCCO CORNICES. Pl. 5




PL. 37.
A
A

The height of the cornice is taken from *a* down to *b*. The ornamental part below *b* may with propriety be considered as a part of the frieze.

CENTRE-PIECES.

PLATE XXXVII.

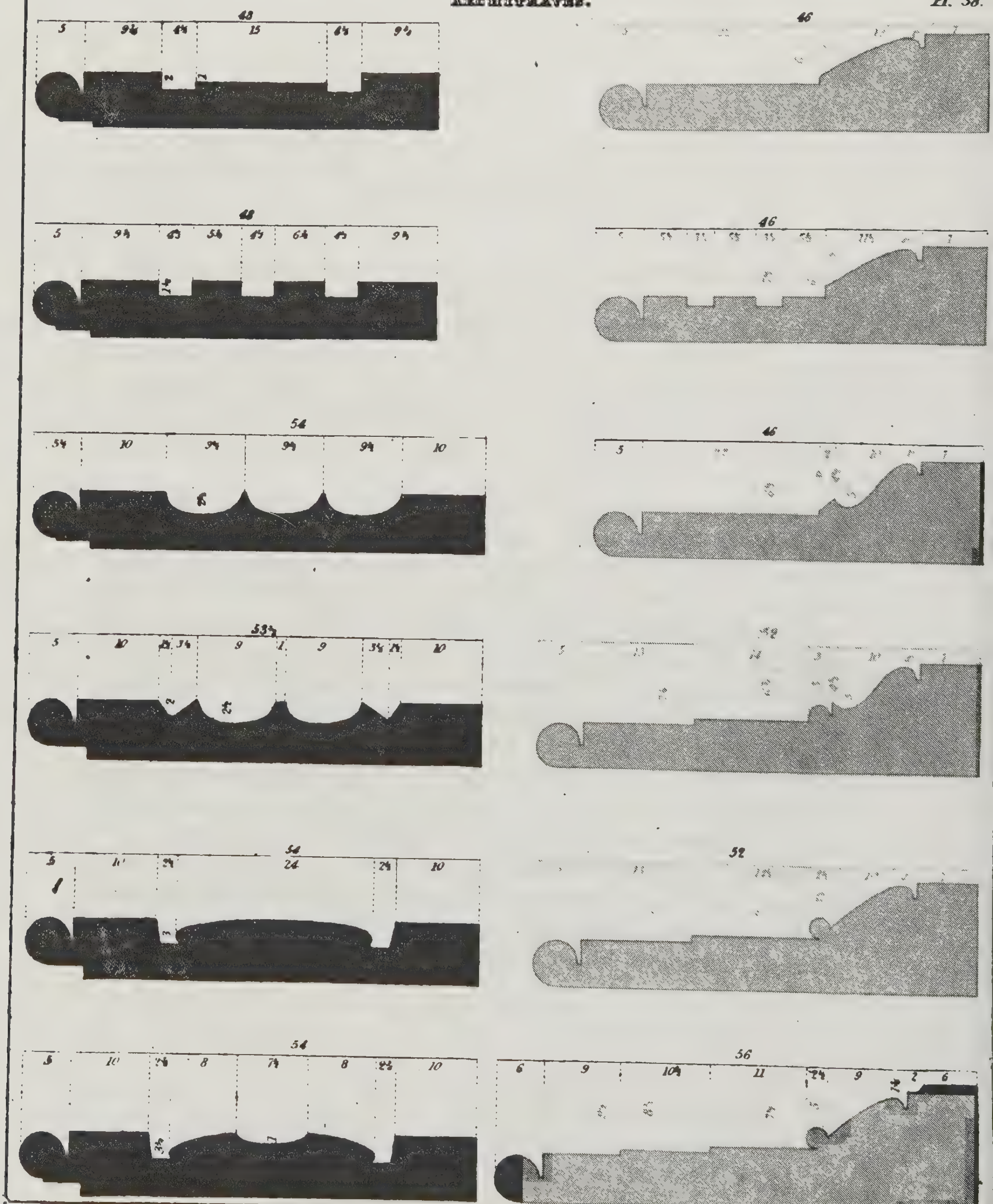
In parlors and other apartments from whose ceilings a lamp is to be suspended, the decoration encircling the hook from which the lamp is suspended is called a centre-piece. I do not know of any precise rule by which the proportions of the centre-piece can be ascertained. In a room of about eighteen by twenty feet, the diameter of the centre-piece should be about three feet, or one sixth of the width of the room, exclusive of the architrave which encircles it. Although this cannot be taken as a general rule, it will nevertheless assist the judgment in adjusting the proportion. Three different examples are exhibited here, and two examples for the mouldings which encircle them. These mouldings are drawn one half of the full size. A and A show the depth to which the flowers are recessed up into the ceiling.

ARCHITRAVES.

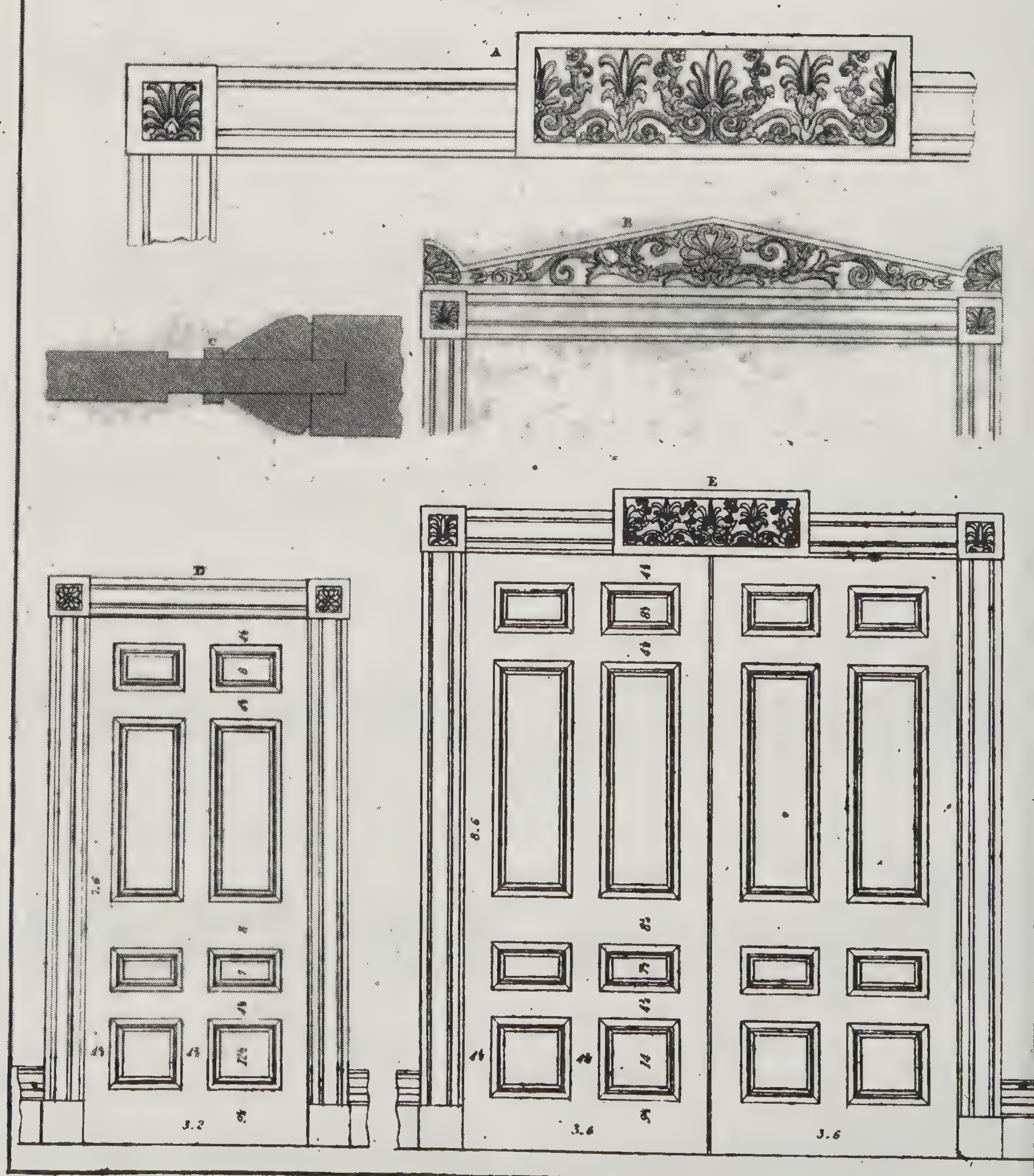
No one of the elements of Architecture is more frequently employed, or of much more importance, than the architrave. Doors, windows, niches, &c. are all more or less indebted to the architrave for their principal decoration. It is therefore of importance that the construction of this element should be as perfect as possible, in relation to its size, symmetry, economy, and adaptation to its place. The mouldings which decorate its face should be few, bold, and expressive.

The breadth has generally been determined by a given portion of the breadth of the door, window, &c. of the room where this element is employed. But this rule will not always apply; since the breadths of the door and the window in the same room are not equal, and sliding doors, when employed to connect the two parlors, are generally something more than twice the breadth of the other doors of the room. The door to a room of common dimensions, say sixteen by eighteen or twenty feet, and ten feet in height, will be about three feet in breadth and seven in height. One sixth part of three feet will be six inches, which would be a proper breadth for the architrave, if there were no other circumstances in the case. But the windows in the same room would be about four feet in breadth. One sixth of four feet is eight inches, which would be too much for the breadth of the architrave, as would likewise a medium between the two. Judgment, improved by practice, must therefore settle this question. The proper breadth in this case would probably

ARCHITRAVES.



DOORS. Pl. 39.



be about six and three fourth inches, except in the case of a sliding door, which would increase the breadth to seven or seven and one fourth inches.

PLATE XXXVIII.

This Plate presents twelve examples of architraves, of different construction and width. They are drawn one half of the full size. The members are figured in such a manner, that if drawn by a common two foot rule, calling each number figured on the Plate one eighth of an inch, an architrave will be produced of just double the size of the one imitated.

DOORS AND THEIR DECORATIONS.

No department in any building can be complete, without one or more of these useful and ornamental portions of Architecture. Their beauty or deformity depends on their construction and adaptation to their place. To arrange the size and proportions of his doors, the mechanic must resort to his own judgment, which, though not assisted here by any precise or definite rule, will by a course of attentive practice soon acquire sure and infallible guides.

A door cannot be useful, unless it be of sufficient size for persons of full stature to pass and repass freely, without stooping or passing sideways. Two feet two inches in breadth, and six feet four inches in height, is therefore the smallest size. No internal door

should be more than four feet in breadth, and about eight and one half feet in height, be the room ever so large. If a greater breadth is desired, make the door in two parts.

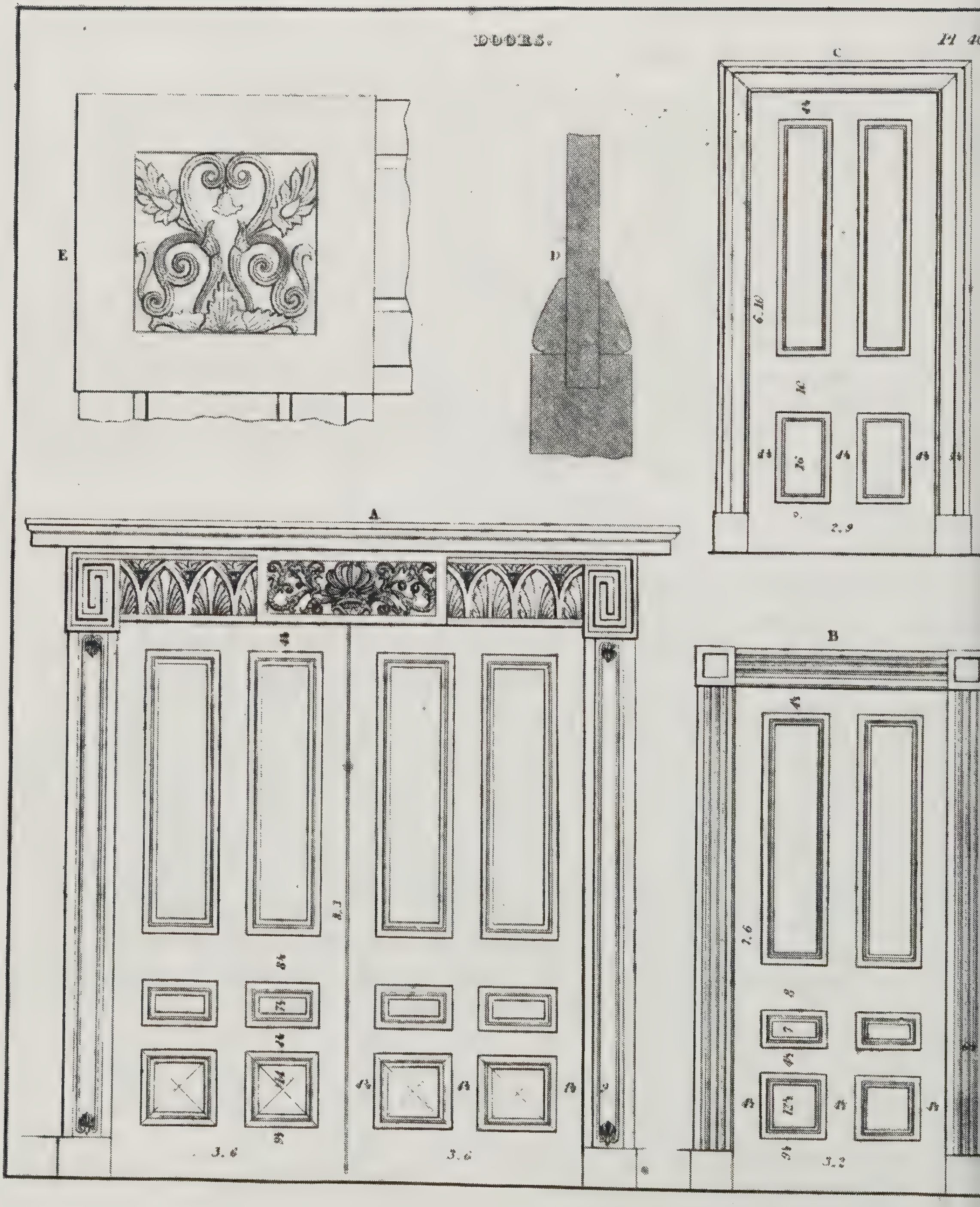
If a room be fifteen by eighteen feet, and ten in height, three feet in breadth and seven in height will be a good proportion for the door; but if the size of the room be increased to eighteen by twenty feet, and twelve in height, three feet two inches in breadth and seven feet six inches in height will be a suitable proportion.

Folding or sliding doors are frequently employed to connect the two parlors; in which case it will be proper to increase their altitude above that of the other doors of the same room, about one foot; and as they are made in two parts, divided vertically, each part should be somewhat broader than the other doors.

PLATE XXXIX.

This Plate exhibits a design for an eight panel door, and a pair of sliding doors, suitably constructed for the same apartment. They are decorated with their usual ornament, the architrave, showing the termination against the block at the upper angles of the door. This block should project about one eighth of an inch beyond the outer edge and front of the architrave. A shows the tablet and the block at the angles, with the sculpture recessed into both. This kind of sculpture should not project much beyond the frame that contains it.

This example is drawn from a scale of one half of an inch to a foot. B exhibits another example for the finish over sliding doors, drawn from the same scale as A; and C, a section of the moulding one half of the full size. The doors with their details are figured in feet and inches.


DOORS.
Pl 40
C
E
D
A
B
6.10
2.9
8.3
3.6
3.6
7.6
3.2

DETAILS OF SLIDING DOORS. Pl. 11

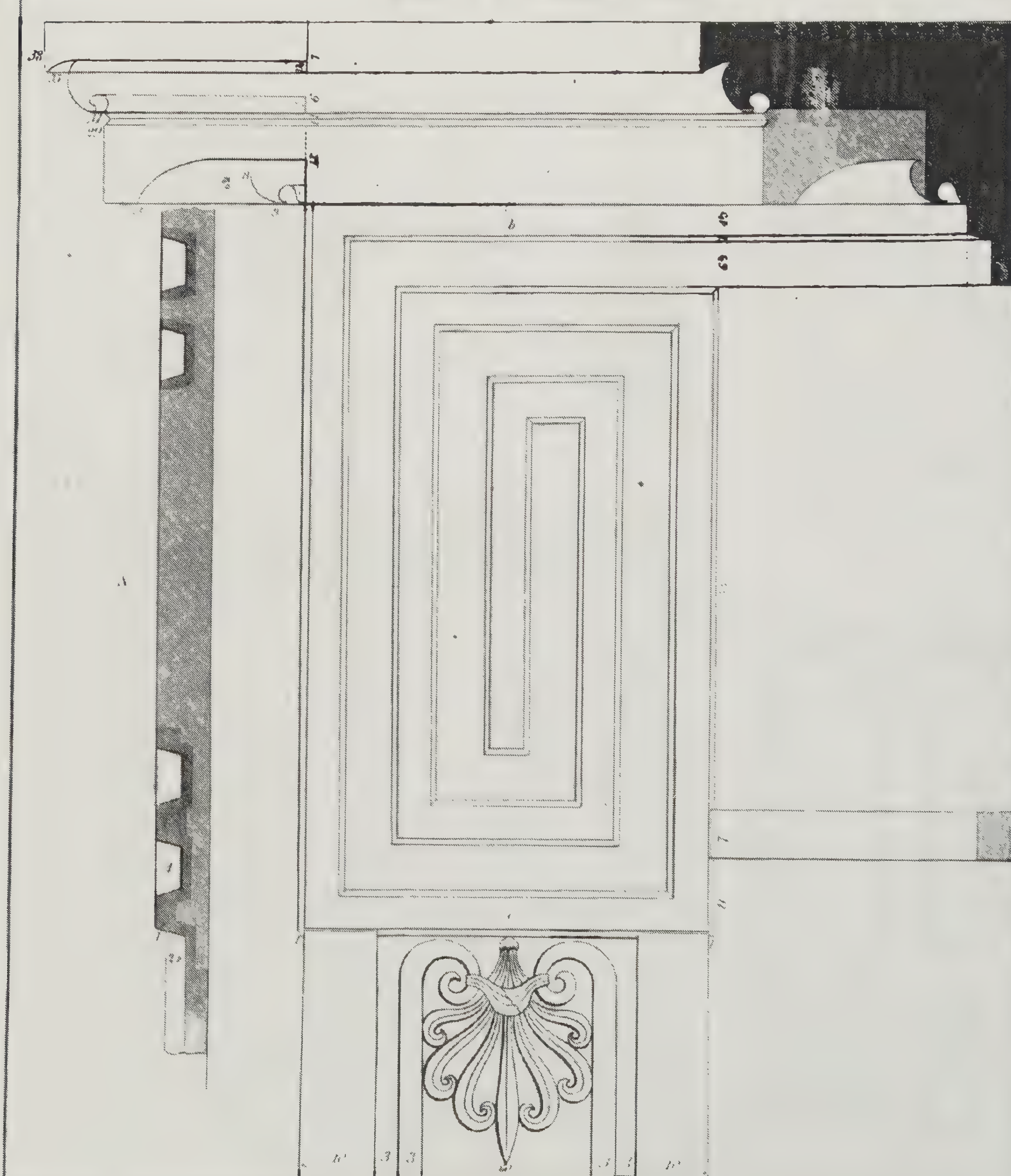


PLATE XL.

The example of a pair of sliding doors here exhibited, decorated with pilasters and an entablature, as a substitute for the finish of those on the preceding Plate, is not in bad taste ; nor will it interrupt the harmonious proportion of the apartment, by means of its decorations. These doors differ from the other doors and windows in their magnitude, situation, and construction.

Two other examples of doors with their decorations are also exhibited here.

WINDOWS AND THEIR APPENDAGES.

PLATE XLI.

No room or apartment can be useful, of course, unless it is capable of receiving a suitable quantity of that necessary article light. The windows, therefore, constitute a very important part of the room. No determinate rule can be given, by which the size of the windows can be adjusted with regard to a due admission of light. The other circumstances to be considered in their arrangement and formation, embrace the height and extent of the building, the number and dimensions of the interior apartments, the number of the windows, and in fact the general style and character of the building throughout. Stability requires that the windows should not be placed too near the angles of the building; and that the piers between them should be nearly equal in size.

Practice seems to have fixed the altitude of the first story windows to twice their breadth; of those in the second story, to something less; and those in the third story, still less.

A suitable proportion for the windows of a parlor of twenty by eighteen feet, and twelve feet in altitude, is two windows, each containing twelve lights of glass of twelve by nineteen inches.

The second story would require the same number of lights of glass, and of the same width, but seventeen inches in length. In the third story, the length of the glass should be fifteen inches.

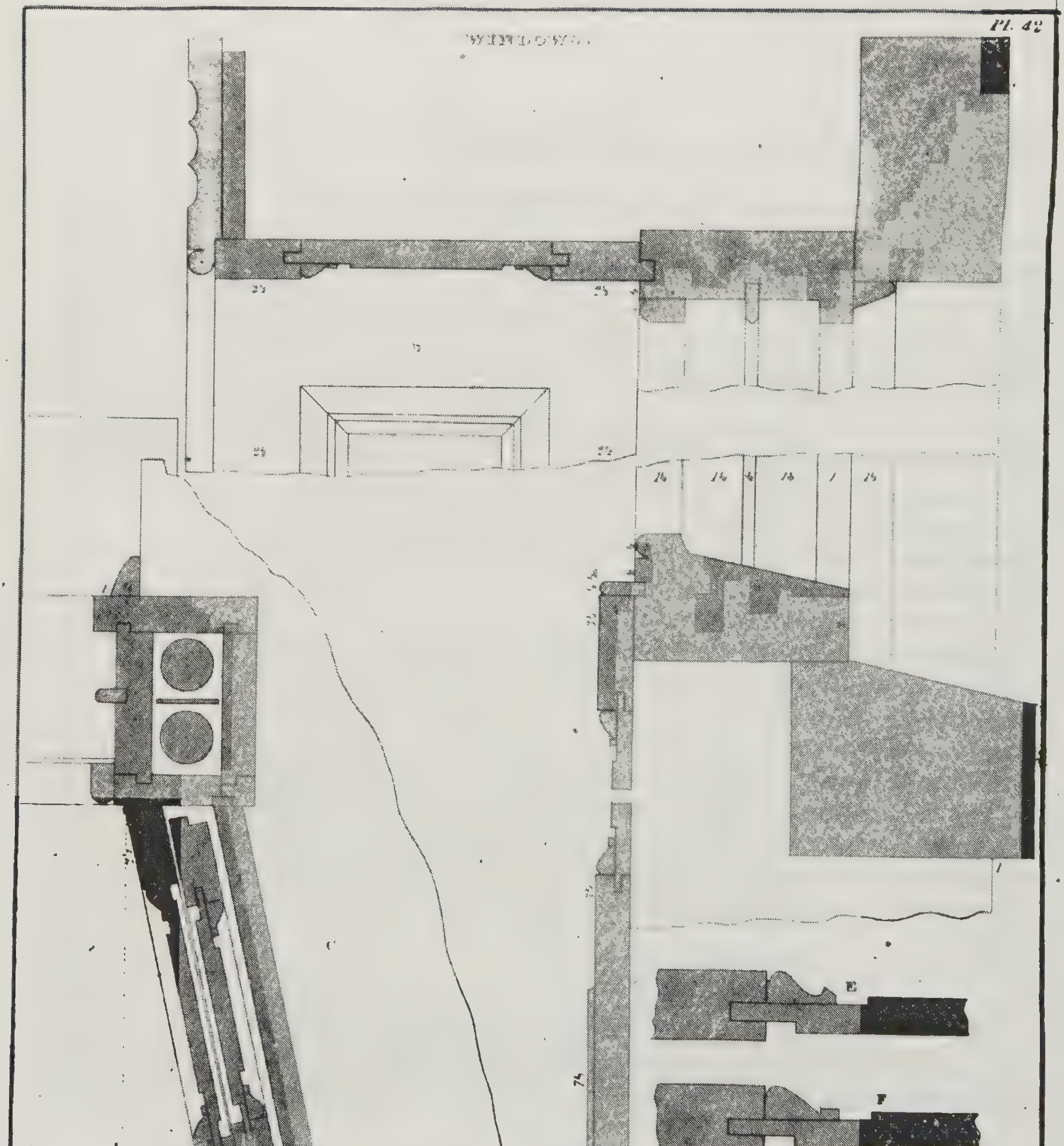
In parlors and drawing rooms it is a common practice to add to the length of the windows by extending them down within about seven inches of the floor; and in that case, to divide the height into two casements, the lower one containing three lights of glass in height, and the upper one two.

Venetian windows are sometimes employed in rooms and other apartments, and in some instances properly; but these instances rarely occur. It is advisable to avoid their use, if possible; because they are seldom made to harmonize with the other portions of architecture by which they are surrounded, and it is exceedingly difficult to accommodate them with either shutters or blinds, without sacrificing some other convenience. The centre window may be in height twice its breadth; and each side window in breadth not less than one third, nor more than one half of that of the centre window.

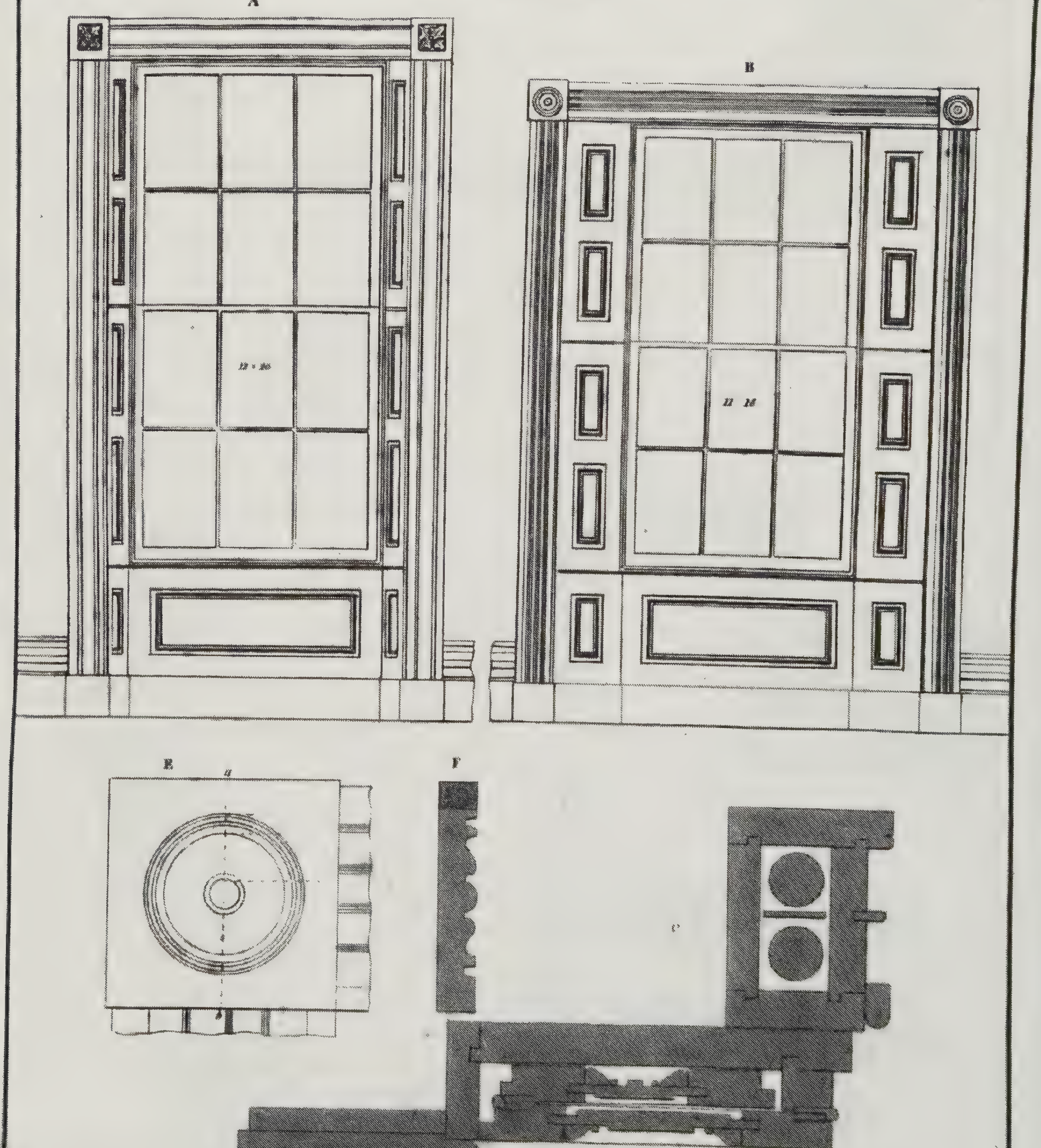
PLATE XLII.

This Plate exhibits a vertical section of the sash frame, showing its cap and sill, the soffit, architrave, and grounds, and their connection with each other; also the back, and its connection with the

WINDOWS



WINDOWS. Pl. 43



plinth and sill of the frame. It gives likewise an elevation of the sash from the upper extremity of the shutter, and a part of the brick work, together with a section of the stone cap and sill, with their details figured in inches. C exhibits a horizontal section of the sash frame, showing distinctly all its details; and also the back lining, grounds, shutters and architrave, with their connections with each other. These details are drawn one fourth of the full size. E and F represent sections of a part of a stile and panel, and the moulding for shutters, drawn one half of the full size.

PLATE XLIII.

A exhibits an interior elevation of a window, clearly showing all its details placed in their proper position, drawn from a scale of one half inch to a foot.

B shows an interior elevation of a window differently constructed from the last. It is supposed to be situated where a sufficient quantity of room cannot be spared for folding the shutters into the wall. In such a case this example makes a very good substitute; and where the piers between the windows are large, or when only one window is situated in the same side of a room, it makes a finish far from disagreeable.

C exhibits a horizontal section of the sash frame of the shutters, back lining, jamb casing, grounds and architrave, drawn one fourth of the full size. E shows the block against which the architrave finishes at the upper angles of the window, with a turned rosette in its centre. A section of it, taken through the centre from *a* to *b*, is exhibited at F.

BASE MOULDINGS AND THEIR PLINTHS.

These important members make a finish at the lowest extremity of the room. Until recently, they made the lowest member of the base, dado, and surbase; but it is fortunate, as it regards economy and correct taste, that the two latter members have been expunged from that kind of finish. The base and its plinth, therefore, assume a more important character than when they constituted only one of the members of the pedestal, or dado; and its height must be somewhat increased, and bear some relation to the altitude of the room. Although the exact size cannot be determined by any given portion of the room, yet a proper consideration of the altitude and size of the room will direct the judgment to a correct proportion.

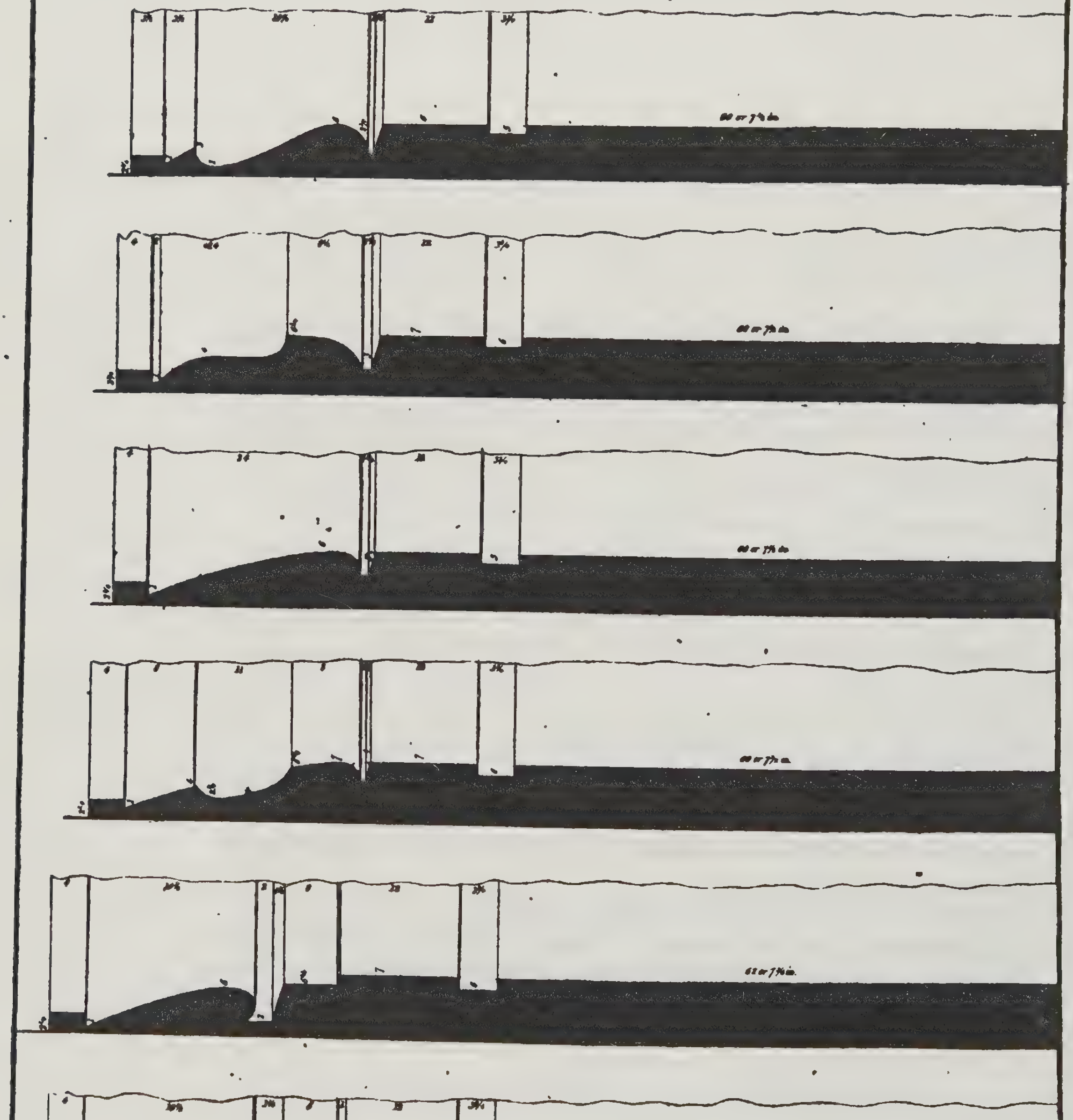
PLATE XLIV.

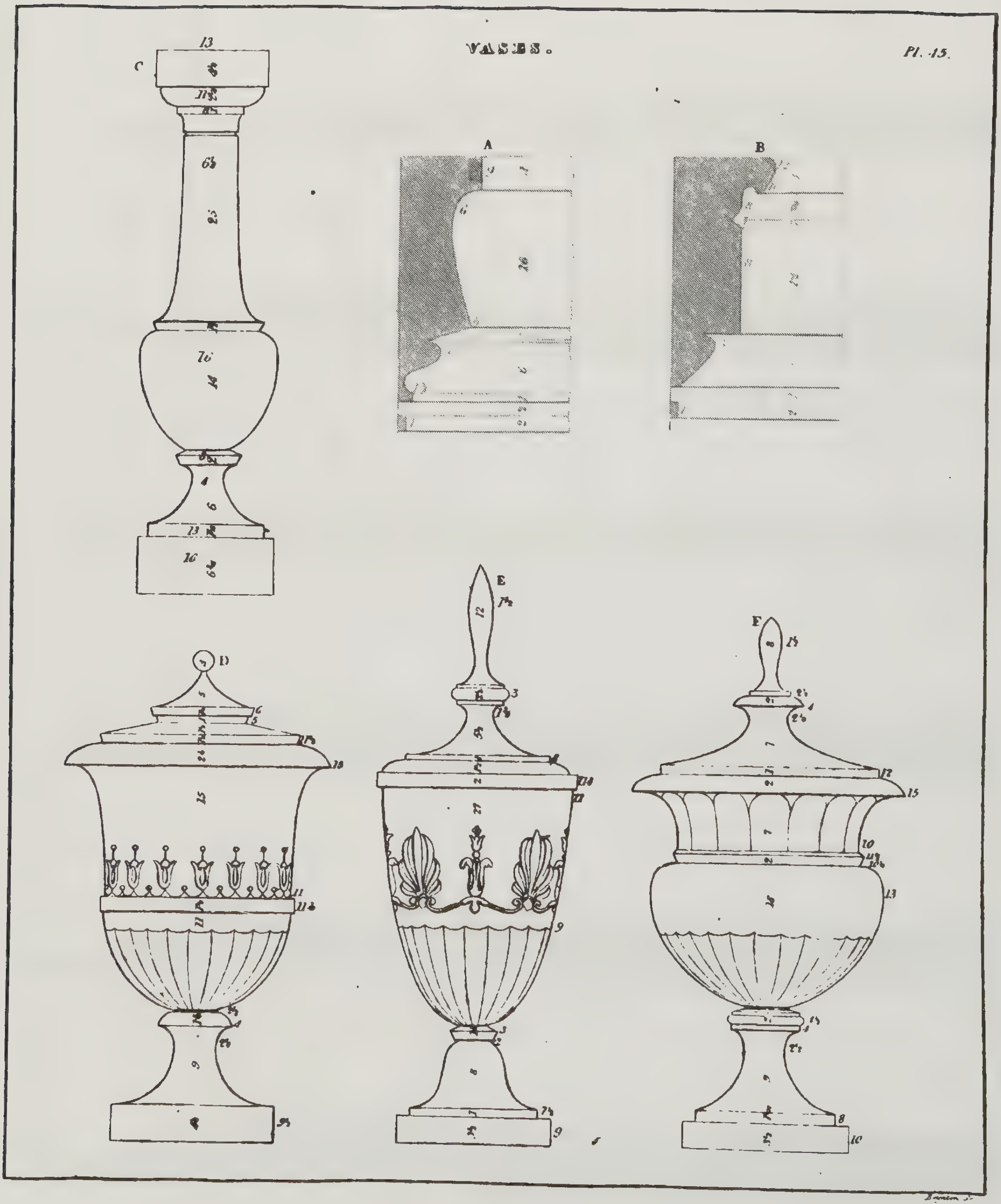
On this Plate are exhibited six different examples of base mouldings, including their plinths, drawn one half of the full size for practice. The height and projection of each member are figured in parts.

Like the architrave before explained, each one of these parts is equal to one eighth of an inch. These mouldings will be found expressive and imposing, though neither of them projects more than seven eighths of an inch.

BASE MOULDINGS.

Pl. 44




VASES.
Pl. 15.
A
B
C
D
E
F

VASES.

PLATE XLV.

At A and B, on this Plate, are presented two designs for surbase mouldings, which are drawn one half of the full size. For the convenience of enlarging or reducing their size, the members are figured in parts.

C exhibits an example for a baluster, which is four diameters in height; but it may be adapted to any situation, by either increasing or diminishing its height, as the case may require. Its members are figured in parts.

D, E, and F, present three examples for vases of different forms and proportions. It will be wise to imitate carefully the particular form of their outline. They are suitably constructed for the termination of pedestals, or posts. The largest diameter of these vases should not be quite equal to that of the pedestal or post which they decorate, nor less than three fourths of the same. Each member is figured in parts, and the proportions are reckoned from the central line.

ORNAMENTAL MOULDINGS.

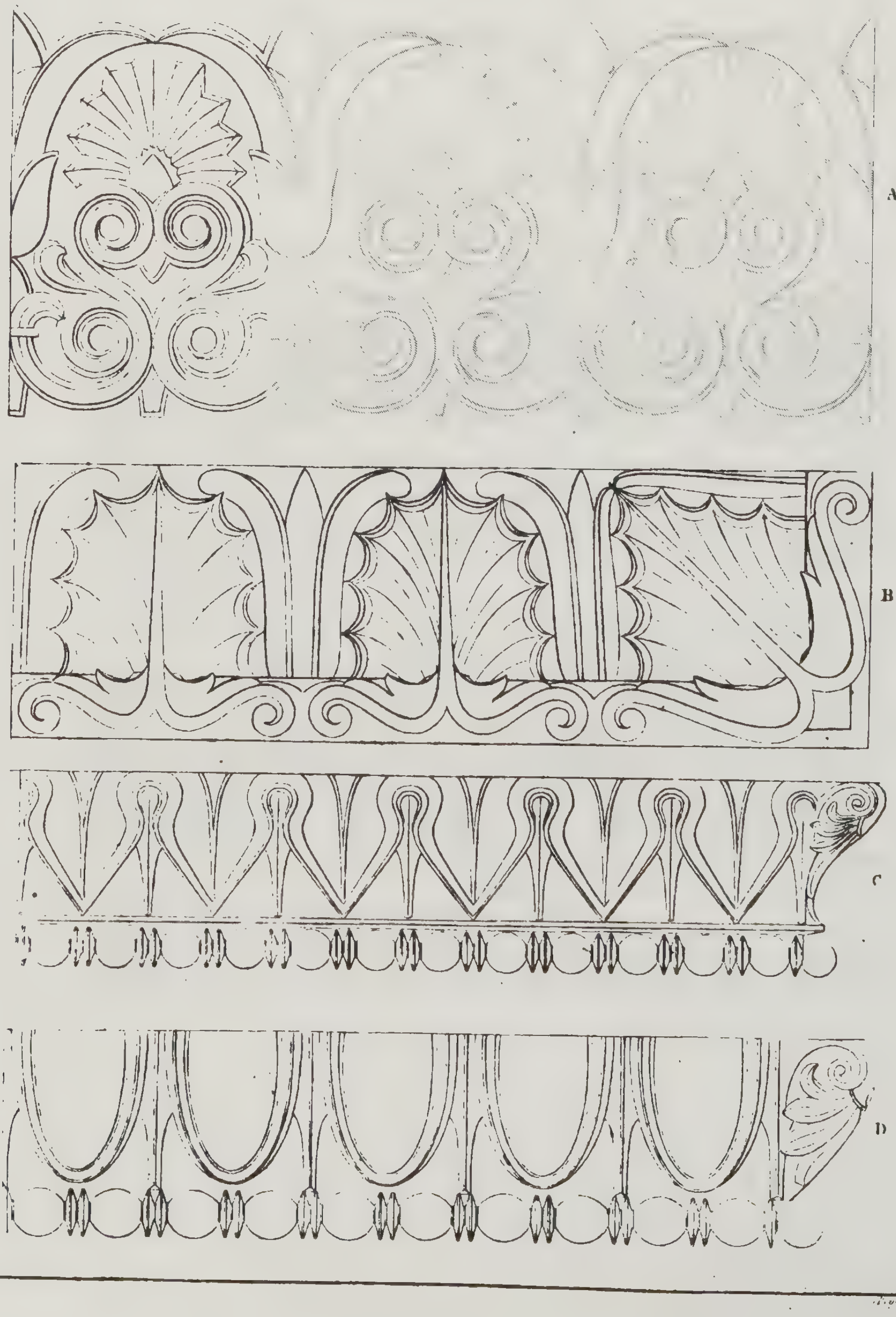
PLATE XLVI.

Ornaments are more or less valuable, as they harmonize with surrounding objects. It is wise and prudent to use them with a sparing hand; for their absence from the composition does not necessarily imply defect, though it might present an appearance too plain and naked to a good judge. But a work unnecessarily loaded with ornaments will be disfigured, not embellished, by them. In the execution of ornaments, the subject intended to be imitated, whether it be the chestnut, the egg, or the acorn, they being the usual enrichments of the ovolo, should be so deeply cut into the moulding as to produce the appearance of their being almost detached from it. The same observations will equally apply to the berries, or beads, which are the standing ornament of the astragal.

When ornaments are liable to close inspection, every part should be well expressed and neatly finished; but when their situation is such that they can be seen only at a distance, the nice finish may be omitted, but their details must be strongly expressed. In sculpture, a few rough, bold strokes, from a skilful hand, express the subject intended for imitation more effectually than the most elaborate unskilful efforts would be able to do.

A presents an example of an ornament suitably formed for flat surfaces. It is of Grecian origin, and expresses the simple, chaste character for which all their examples of ornaments are so remark-

ORNAMENTAL MOULDINGS. Pl. 46.



able. B, C, and D, are likewise Grecian. They are suitably constructed for mouldings, and if well executed will have a handsome appearance.

CHIMNEY-PIECES.

This portion of Architecture is highly ornamental, when tastefully constructed. The magnitude of a chimney-piece does not always correspond with that of the room in which it is situated. A room, for instance, of fourteen by eighteen feet, requires a fire-place of three feet in breadth and two feet ten inches in height; but one of twenty by twenty-eight feet, does not need a fire-place more than three feet six inches in breadth and three feet in height. A due consideration of all the circumstances of the case is therefore necessary, to give to the chimney-piece such a size as will best harmonize with the magnitude and finish of the room.

Columns are often employed in their decoration. This practice is, however, in small plain rooms, to be avoided; because the chimney necessarily projects into the room about one foot, and if the projection of the columns be added, it will have the effect of reducing the breadth of the room very considerably, in a place, too, where the width of the room is of the most importance. Besides, although a column and its entablature, when of sufficient magnitude, is one of the most beautiful portions of Architecture, yet it must be remembered, that when reduced to small dimensions its details are also proportionably reduced, and their appearance rendered small

and indistinct, by which means the order loses a great portion of its beauty. In large apartments, and where the space occupied by the columns is not important, they may sometimes be employed to advantage. But it is believed that there are few situations, in common practice, where pilasters cannot be so constructed as to render them more appropriate and less expensive than columns.

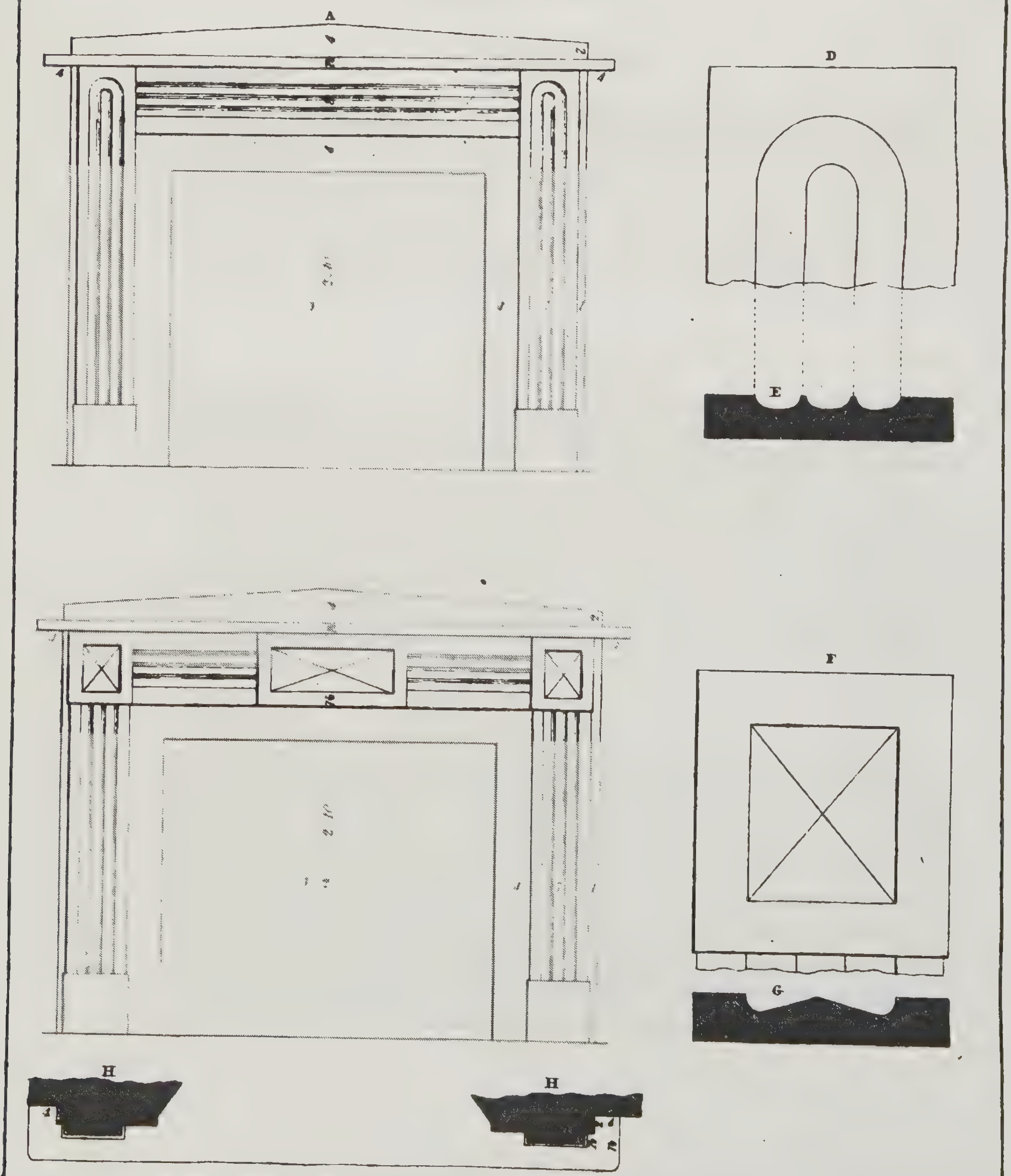
PLATE XLVII.

This Plate presents, at A and B, two examples for chimney-pieces, suitably constructed for common-sized and plainly-finished rooms. They are drawn from a scale of three fourths of an inch to one foot. D exhibits the finish of the flutes at the upper extremity of the pilaster, and E a section of the same. F shows an elevation, and G a section of the block ornament and diamond panel, drawn one quarter of the full size. H and H represent the plans and projections of the pilasters, the plinths, and also the projection of shelf or cornice.

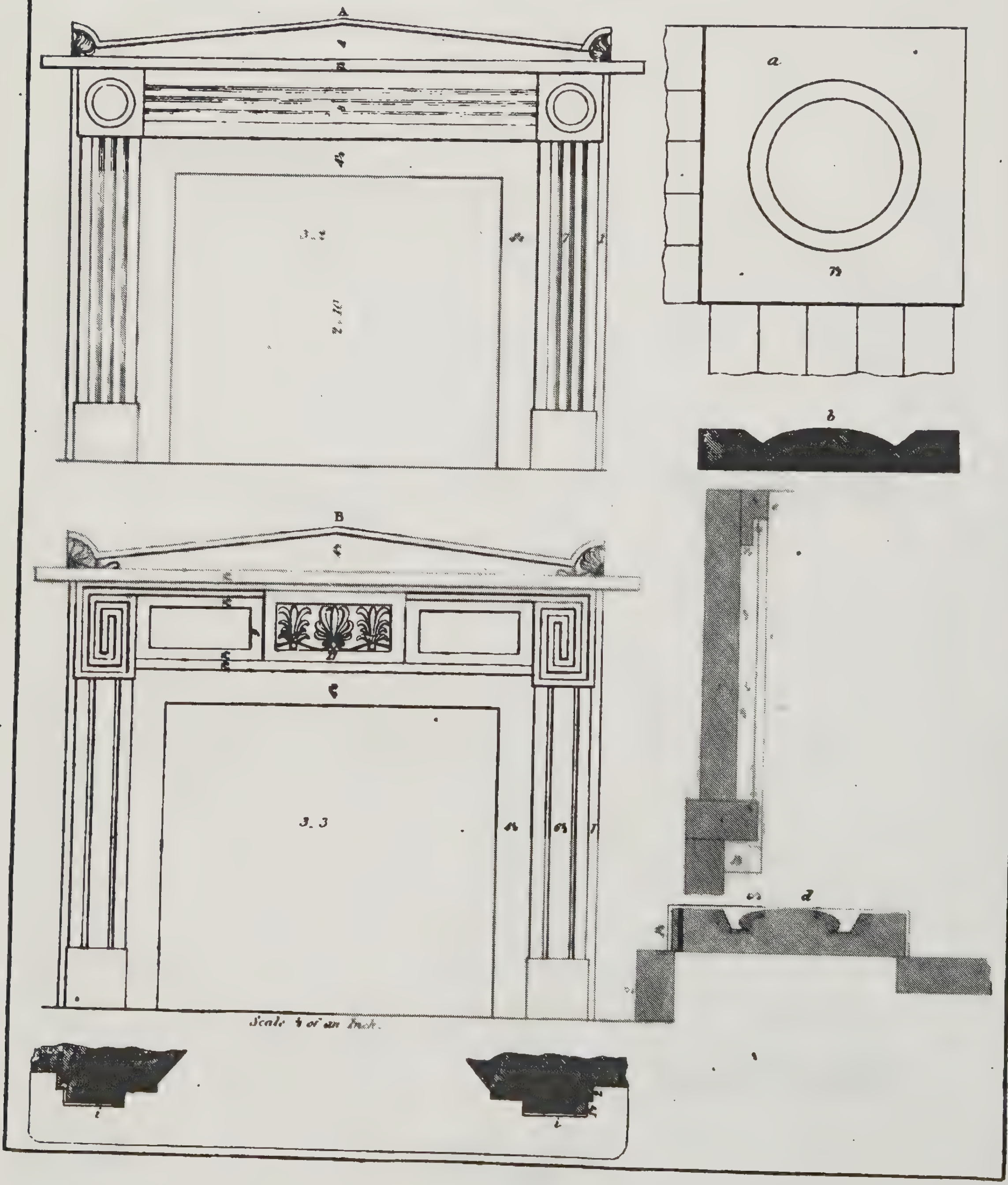
PLATE XLVIII.

Two designs for chimney-pieces are exhibited on this Plate, of a richer character than those last described. They are suitably formed for rooms of something more than the common size. *a* presents the elevation, *b* the section to the block ornament to A, and *c* shows a vertical section of the block ornament to B, taken through the centre of the fret. *e* is a section of the fillets of the fret passing from the block to the tablet. *f* is a section of the band to the architrave, and *g* a section of the frieze, drawn one quarter of the full size. *i* and *i* present sections of the plinths, and also of the cornice.

CHIMNEY PIECES. Pl. 47.



CHIMNEY PIECES. Pl. 48.



Scale ¼ of an Inch.

STAIRS.

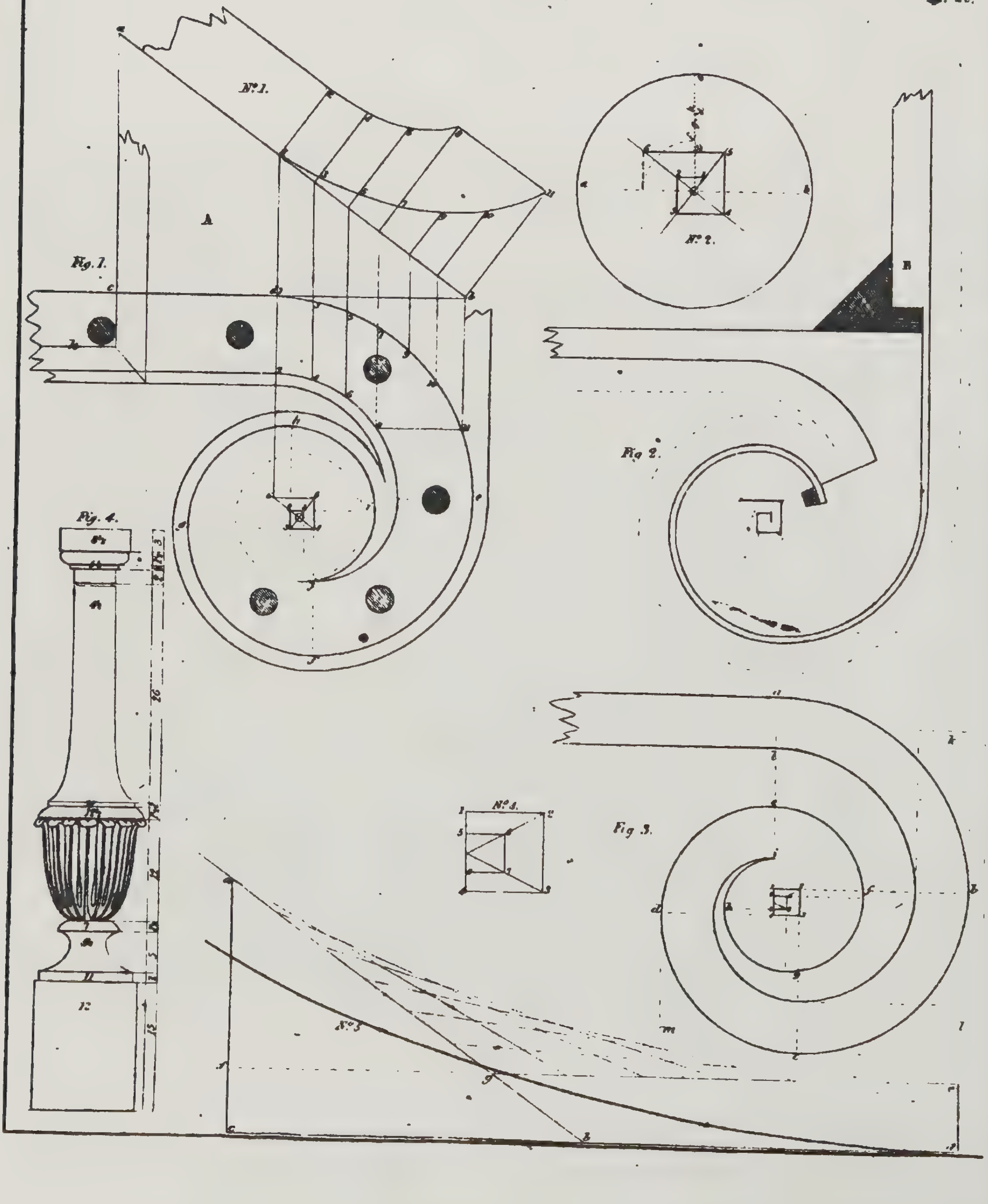
Every building consisting of more than one story is indebted to this portion of Architecture for ornament, as well as utility. The height, breadth, and length of the steps, should be proportioned to the situation and use for which they are constructed. This remark, however, is subject to this qualification, that the height should never exceed eight inches, nor the breadth twelve. Every workman is supposed to have a sufficient knowledge of all kinds of stairs, except those on a circular plan. The method most practised, of forming the circular part of the rail without a cylinder, is comparatively of recent date. To the ingenious Peter Nicholson, of London, we are all indebted for this method. It was invented by him and published in the year 1792, and since that time it has wonderfully extended itself into practice. In the year 1795 I made the drawings and superintended the erection of a circular stair-case in the State House at Hartford, Connecticut; which, I believe, was the first circular rail that was ever made in New England. This rail was glued up around a cylinder in pieces of about one eighth of an inch thick. Since the first discovery of the true principles of hand-railing, Mr. Nicholson has made several important improvements; for one of which, about twelve or thirteen years since, the Society of Arts in London awarded him a gold medal. This improvement renders the subject the most simple and direct of any of his methods. I have therefore adopted it as my model here, with some trifling deviations.

PLATE XLIX.

This Plate exhibits two examples for scrolls, which terminate the lower extremity of hand-rails ; one of a curtail step, and one of a newell.

In order to describe the scroll, fig. 1, make a circle of three and one half inches in diameter, as is shown by dotted lines. To illustrate this subject in a clear and distinct manner, the circle is repeated on a larger scale at No. 2. Divide the circle in the centre by the horizontal line *a o b* ; draw the vertical line *o e* ; divide *o e* into three equal parts at *c, d, e* ; through the point *c* draw 6 *c* 5, parallel to *a b*. Divide *c d* into three equal parts at *f, g, h*, and make *c* 6 equal to *o f*. Then from the point 6, and through the centre *o*, draw the diagonal line 6 *o* 4, and intersect it at right angles by another diagonal line passing through the centre *o*, and cutting 6 5 at 5. At right angles with 6 5, draw 5 4, cutting 6 *o* 4 at 4 ; and parallel with 6 5, draw 4 3, cutting 5 *o* 3 at 3. Draw 3 2 parallel to 5 4, cutting 6 *o* 4 at 2 ; and 2 1 parallel to 6 5, cutting 5 *o* 3 at 1 ; which completes the six centres on which the scroll is drawn. We will now return to fig. 1. On the centre 1, with the radius 1 *j*, draw *j i* ; on the centre 2, with the radius 2 *i*, draw *i h* ; on 3, with the radius 3 *h*, draw *h g* ; on 4, with the radius 4 *g*, draw *g f* ; on 5, with the radius 5 *f*, draw *f e* ; on 6, draw *e d* ; which completes the outside circle. The inside line, and also those of the nosing of the steps, are drawn from the same centres.

To draw the face mould, No. 1, the rail is supposed to be glued to the scroll at the line 8 11. A exhibits the pitchboard ; *c b*, the base line ; and *a b*, the raking line. Divide from *d*, the beginning of the twist, to *b*, into any number of parts, making one intersect the edge of the rail at 8, and another at 11. Then draw these lines


No. 1.
A
Fig. 1.
No. 2.
B
Fig. 2.
Fig. 4.
Fig. 3.
No. 4.
No. 3

across the pitchboard to the raking line *a b*. At right angles with *a b*, continue them across the face mould, No. 1. From the line *a b*, make each of the lines 3, 5, 7, 9, 10, and 11, equal to the corresponding lines from the line *d b* to the edge of the rail 3, 5, 7, 9, 10, and 11. Make also 1 2, 3 4, 5 6, and 7 8, in No. 1, respectively equal to *d* 2, 3 4, 5 6, and 7 8, on fig. 1. Then through the points 1, 3, 5, 7, 9, 10, and 11, and also through the points 2, 4, 6, and 8, trace the curves; and the face mould is completed.

Fig. 2 exhibits a curtail step drawn from the same centres as that of the rail. B shows the edge of the riser; C, a block glued to both step and riser; D and E, keys by which the riser is made fast and drawn home to the step. The dotted lines represent the nosing of the step.

To draw the falling mould, No. 5, let *a*, *b* and *c*, be the angles of the pitchboard. Produce the base line *c b*, to *d*; make *c d* equal to the stretchout of the scroll on fig. 1; from *d*, around to *f*, set up the depth of the rail, which is supposed to be two inches, to the line *f g e*. Then divide *a g* and *g e*, each into a like number of equal parts, and form the curve by the intersection of lines. The curve of the lower edge may be obtained by gaging.

Fig. 3 exhibits another method of describing a scroll of two revolutions, the beginning and termination of which are given. *a* represents the commencement, and *i* the termination. Divide *i a* into two equal parts at *l*; subdivide *i l* into one more part than the number of revolutions required, in this case into three parts. Make the square in the centre equal to one of those parts, and construct it like that at No. 4, which is drawn on a large scale. Then on 1 in the square, and with the radius *i a*, draw the quadrant *a b*. On 2, and with the radius 2 *b*, describe *b c*; on 3, with the radius 3 *c*, describe *c d*; on 4, describe *d e*; on 5, describe *e f*; on 6,

describe $f\ g$; on 7, describe $g\ h$; and on 8, describe $h\ i$; which completes the outside line. That of the inside is drawn by the same centres.

It is evident by the dotted lines representing the straight part of the rail at $k\ l$ and m, that four scrolls of unequal sizes may be obtained by this example.

Fig. 4 exhibits an example of a newell, drawn on a large scale and figured in parts. Its size is supposed to be six inches at the base. Each part would therefore be equal to one half of an inch. Where there is not a sufficient space in the entry that can be conveniently spared, this newell will be found a good substitute for the scroll.

PLATE L.

To find all the moulds which are necessary for the completion of a stair rail standing over a circular plan, as exhibited at fig. 1, we proceed as follows:

Make $a\ b$, No. 2, equal to the height of the winders. Draw $a\ e$ and $b\ f$ at right angles with $a\ b$; make $e\ a$ and $b\ f$ each equal to the development of $e\ a$, fig. 1 ; draw $e\ x$ and $d\ k$ each equal to the height of one step, and parallel to $a\ b$; make $x\ l$ and $f\ d$ each equal to the breadth of one step, and join $e\ l$, $e\ f$, and $f\ k$. Make $e\ t$ equal to $e\ l$, and $f\ s$ equal to $f\ k$. Then form the curves, or easoffs, by the intersecting of lines, or by producing lines at right angles from the rail, as represented by the dotted lines u and v, until they meet, and their junction will be the centre for describing the curve. The breadth of the falling mould is generally about two inches ; a line, therefore, about one inch above the one here described, and another at the same distance below, will complete the falling mould.

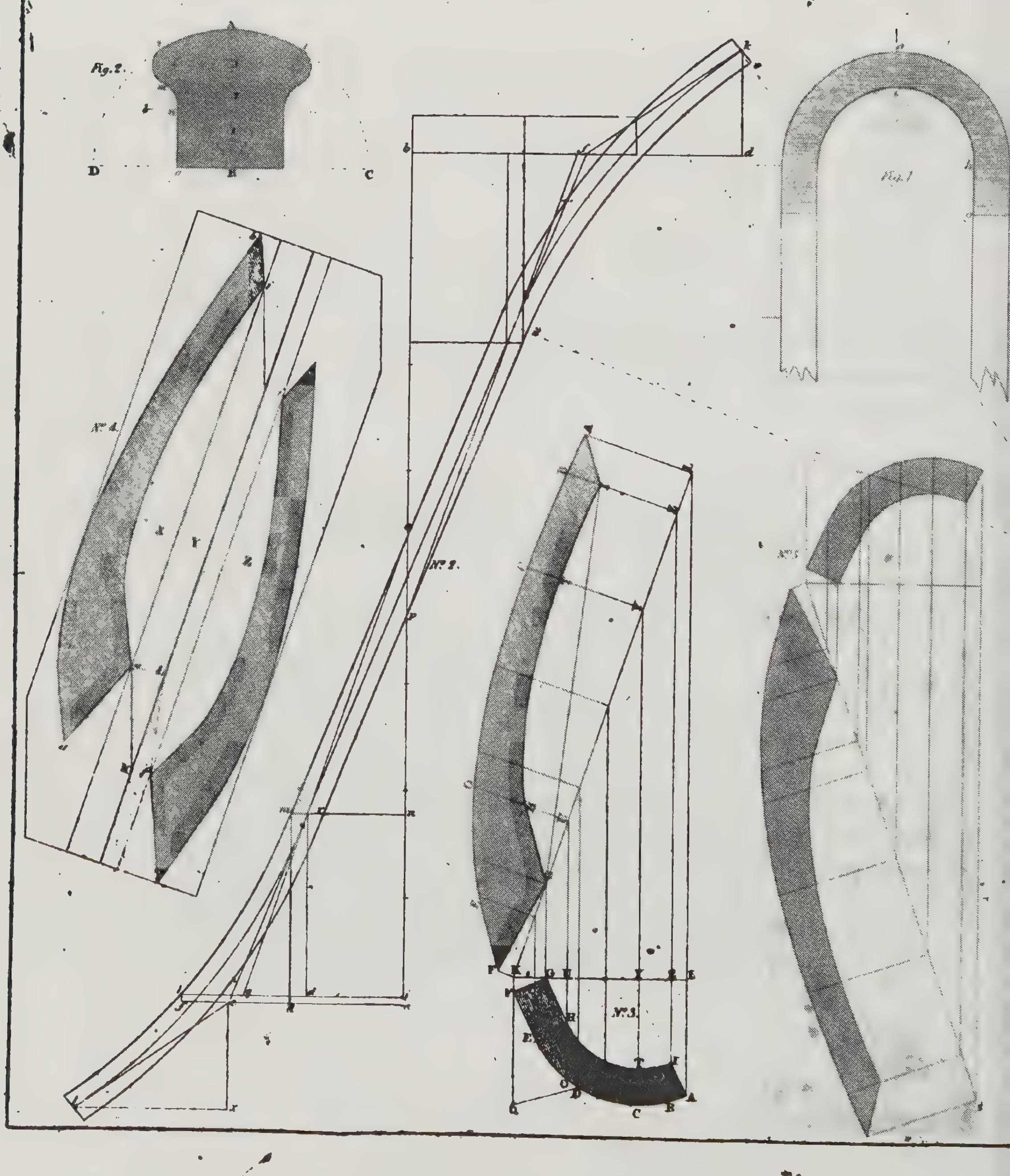
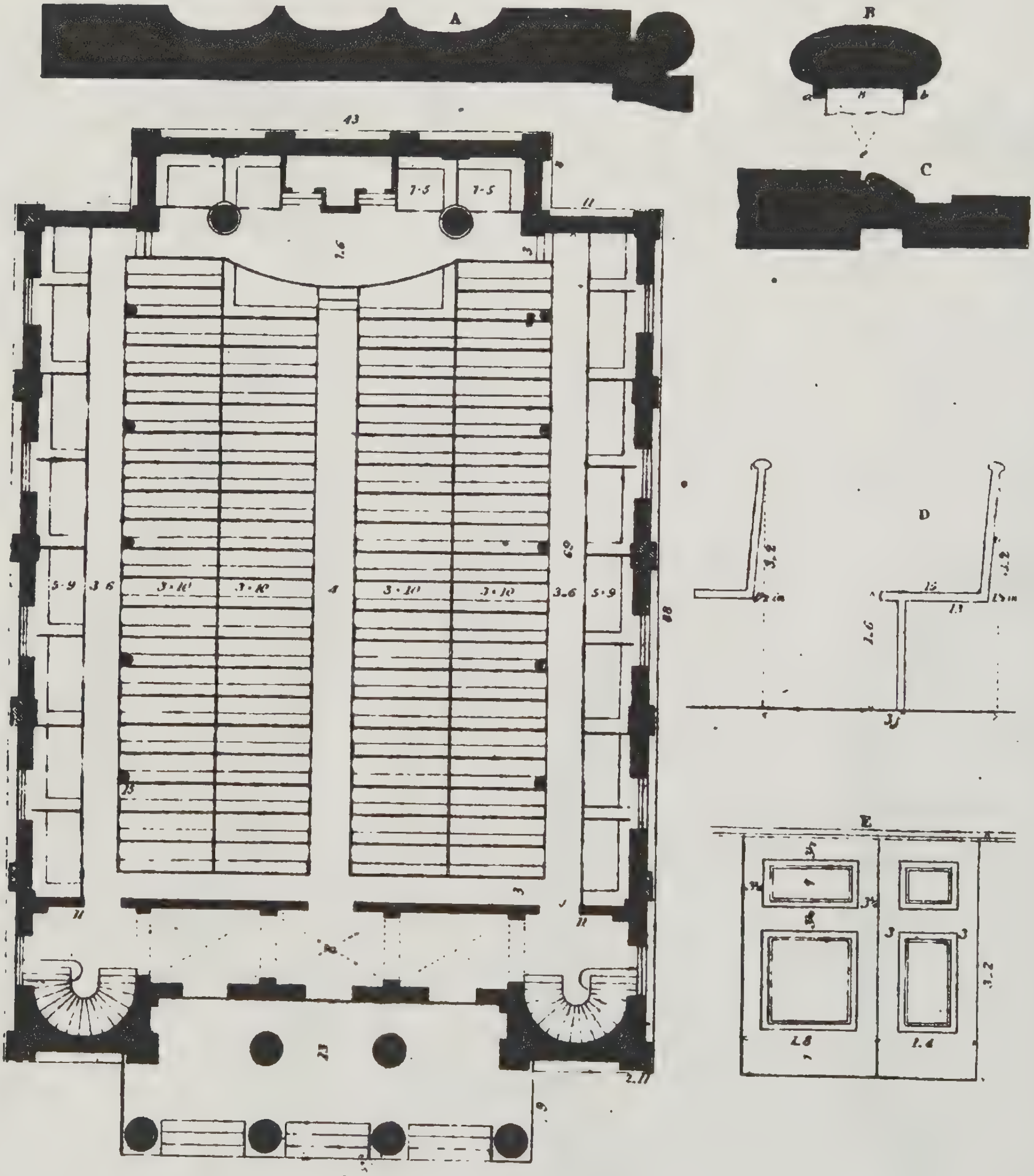


Fig. 2.
D
B
C
Nº 4.
X
Y
Z
Nº 2.
Nº 3.
Fig. 1

GROUND PLAN.

Pl. 51.



Construction of the Face Mould, No. 3.

Let A D E F G H I be the plan of the rail, and E F, G H, a portion of the straight part ; I being the upper, F the lower, and D the middle resting points. Make the stretchout of A D equal to that of D F. In the figure of the falling mould, produce the base *a e* to *f*, *a e* then being equal to the development of A E ; make *a d* equal to the development of A D, and *e f* equal to E F. Draw *f l* parallel to *a b*, and cutting the upper side of the falling mould at *l* ; parallel to *f a*, draw *l i*, cutting *a b* at *i* ; in *i l*, make *i d* equal to I D ; draw *d m* parallel to *a b*, cutting the upper side of the falling mould at *m* ; draw *m n* parallel to *f a*, cutting *a b* at *n* ; and *d r* parallel to *a b*, cutting *m n* at *r*. Join *o r*, and produce it to meet *i l* at *q* ; make I Q equal to *i q* ; join F Q, and produce F Q to K. Through G draw K L perpendicular to K Q ; through I draw I Z parallel to K Q, cutting K L at Z ; make Z Z equal to *a o*, and join K Z. Then produce K Z to L, and draw A L L parallel to Z Z.

To find the Face Mould.

Draw L A perpendicular to K L ; make L A equal to L A, Z I equal to Z I, and join A I. Then A I will form the part of the face mould represented by I A on the plan. Draw K F perpendicular to K L, and make K F equal to K F. Draw G G parallel to Z Z, cutting K L at G, and join G F. Again draw H U parallel to Z Z, and cutting K L at U ; draw U H perpendicular to K L, and make U H equal to U H. Draw H E parallel to G F and F E parallel to G H ; then E F G H will form the part of the

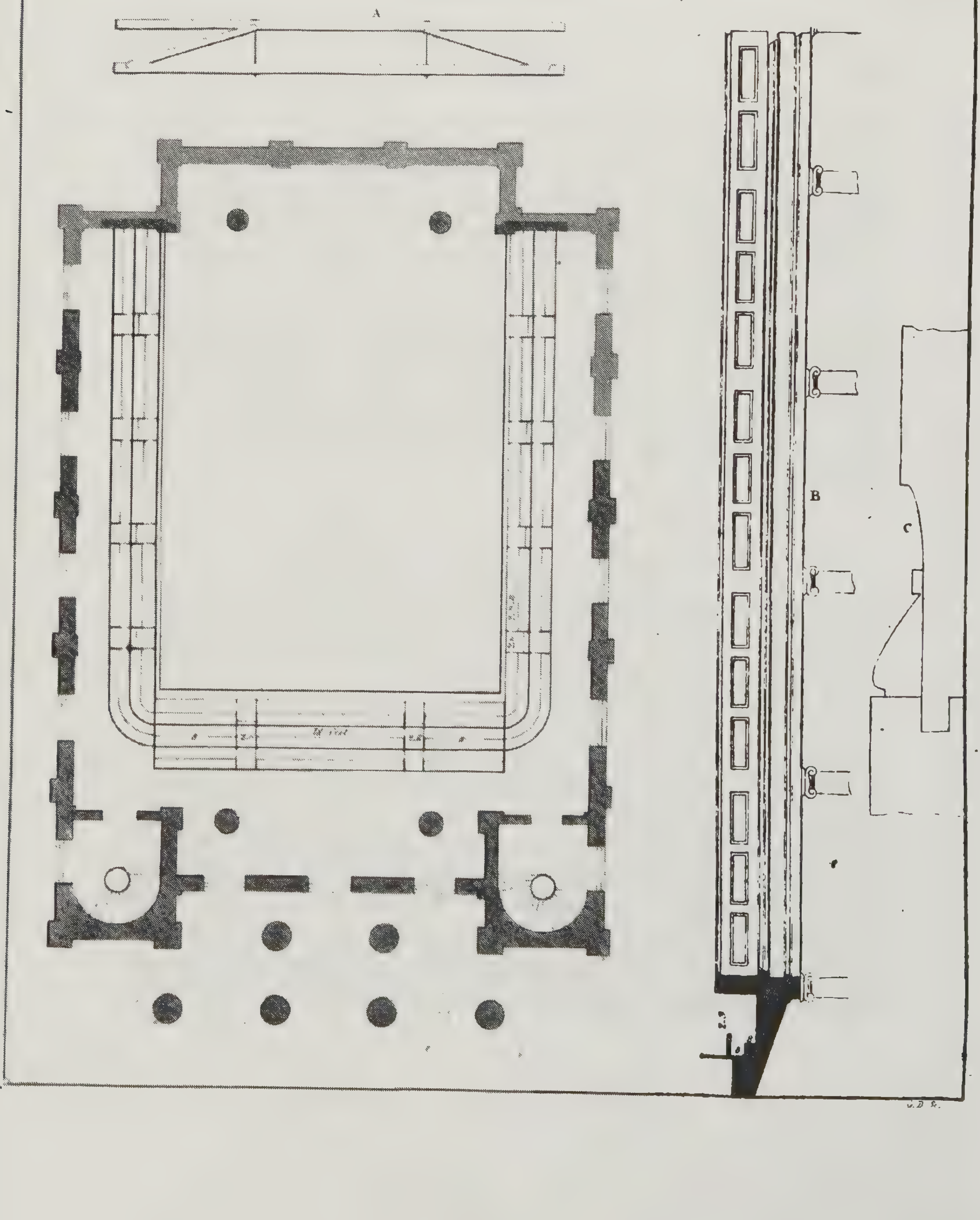
face mould corresponding to the straight part E F G H on the plan. The intermediate points of the face mould, which form curves of the outside and inside of the rail, are thus found. Through any point C, in the convex side of the plan, draw C Y parallel to Z Z, cutting K L at Y; and in the concave side of the plan at T, draw Y C perpendicular to K L; and in Y C make Y T equal to Y T, and Y C equal to Y C. Then T is a point in the concave side, and C a point in the convex side of the face mould. A sufficient number of points being thus found, the curved parts of the face mould may be drawn by hand, or by a slip of wood bent to the curve. No. 5 exhibits a face mould for the upper half of the rail, which is constructed in the same manner with the one just described.

How to apply the Face Mould to the Plank.

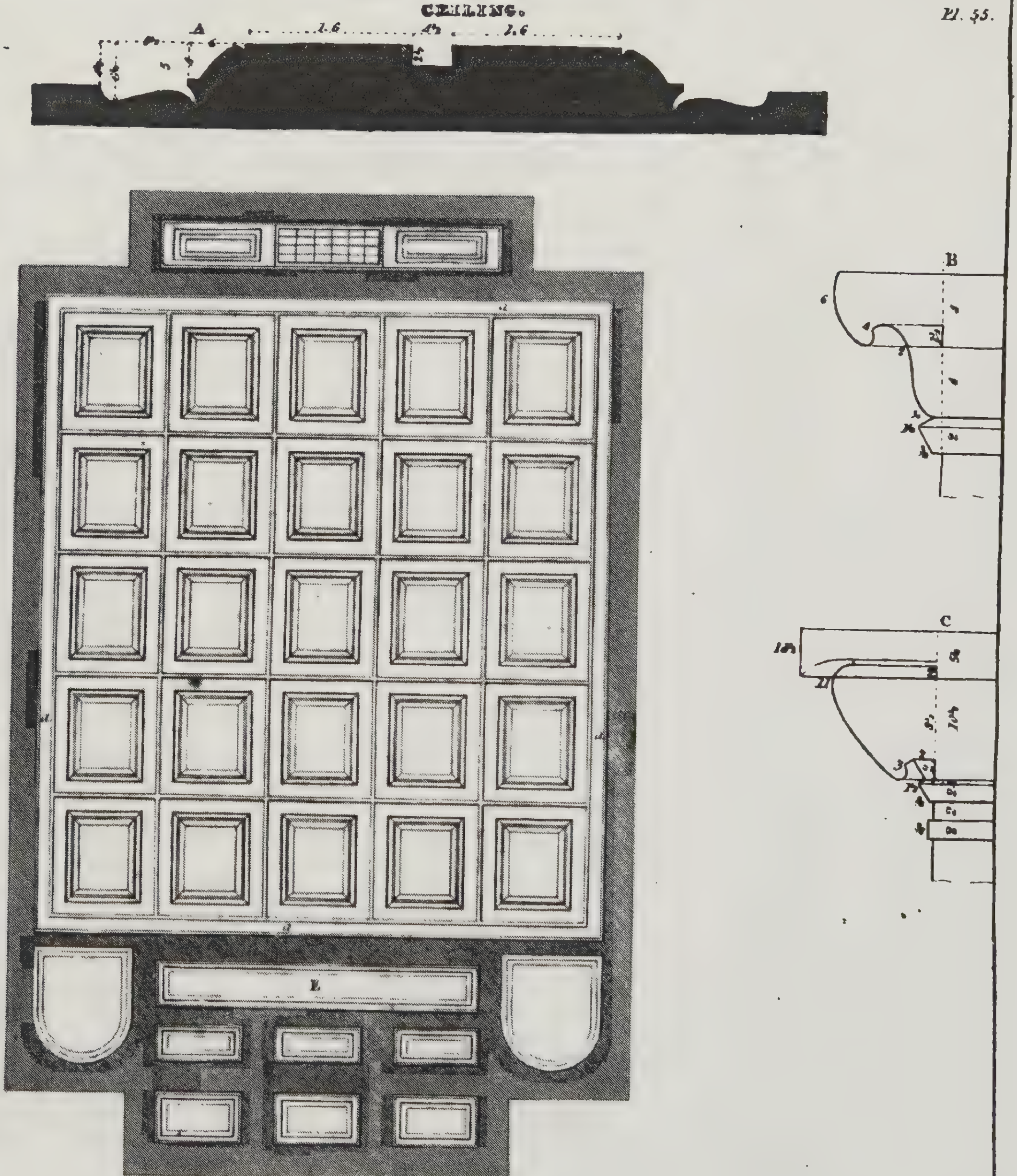
Let *a b i g*, No. 4, be the figure of the face mould, placed in due position to the pitch line K L, as when traced from the plan. X represents the upper side, Y the edge, and Z the under side of the plank, from which the rail is to be taken. Draw *g* L perpendicular to the outside of the plank. Make the angle *g* L K, on the edge of the plank, equal to the angle K L L, No. 3; and the angle *g* L K, on the under side of the plank, equal to the angle G Z I, No. 3. Make *g* L equal to L K, and draw the chord *g i* in the plane Z parallel to the arris line; and then apply the points *g* and *i* of the face mould to the line as exhibited in the figure, and draw the form of the face mould.

Fig. 2 exhibits the section of a hand rail, drawn one half of the full size. On B, with the radius B A, describe the half circle C A D, and divide it into three equal parts. Draw B 1 and B 2;

GALLERY PLAN.



CEILING.



divide A B into four equal parts; draw 3 i parallel to D C, and cutting B 2 at i; draw $i\ l$ parallel to B 1, and equal to one and one half of the four divisions between A and B; on i, with the radius i 2, describe 2 m; and on l, with the radius $l\ m$, describe $m\ n$, and draw $n\ o$.

CHURCHES.

The liberality displayed by the members of this community, in the ample appropriations which they so frequently make for erecting houses of public worship, is highly creditable to them.

The magnitude and beauty of many of these buildings render them honorable monuments of public munificence; and if many of them likewise exhibit a barrenness of invention and ignorance of Architecture, this defect is to be ascribed, not to any fault on the part of those who provide the funds, so much as to the disadvantages under which those labor who are selected to construct the building. We cannot expect a carpenter to shape an edifice in so classic and correct a style as one who confines his labors to the study of Architecture. Let an architect of competent skill be employed to prepare the draught of the building, together with the working drawings for the workmen; and especially, when a plan has been once determined and begun upon, let it not be in any important respects departed from, and buildings of the latter class will soon disappear. Alterations are generally expensive, and are apt to destroy the symmetry of the building.

the architrave under the ceiling of the portico, figured in minutes; and C, the cornice which finishes the upper extremity of the front of the gallery.

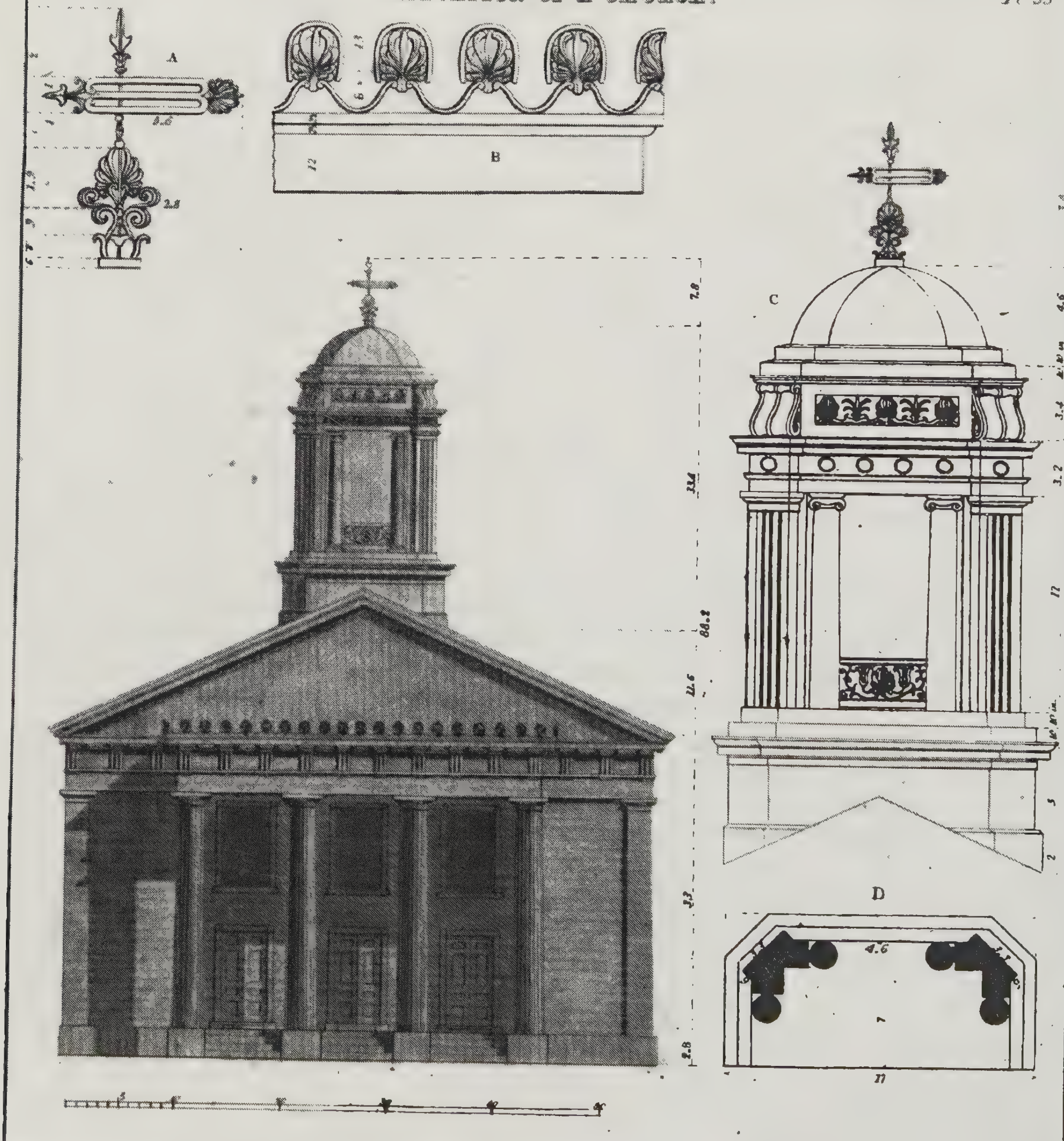
Plate LVI. contains an example of a pulpit. It is drawn from a scale of one half inch to a foot, and figured in feet and inches. C exhibits the outline of the mouldings intended to enclose the panels, drawn one half of the full size; and D, the cornice which is to finish the upper extremity of the desk, figured in parts. It is intended to be three and one half inches in height.

Either of the examples of mouldings on Plate XXXVII. may be imitated in the outline of the face of the pilasters. It is also intended to finish the vacancy between the blocks at the upper extremity of each end of the pulpit, over *a* and *a*, with the same outline of moulding.

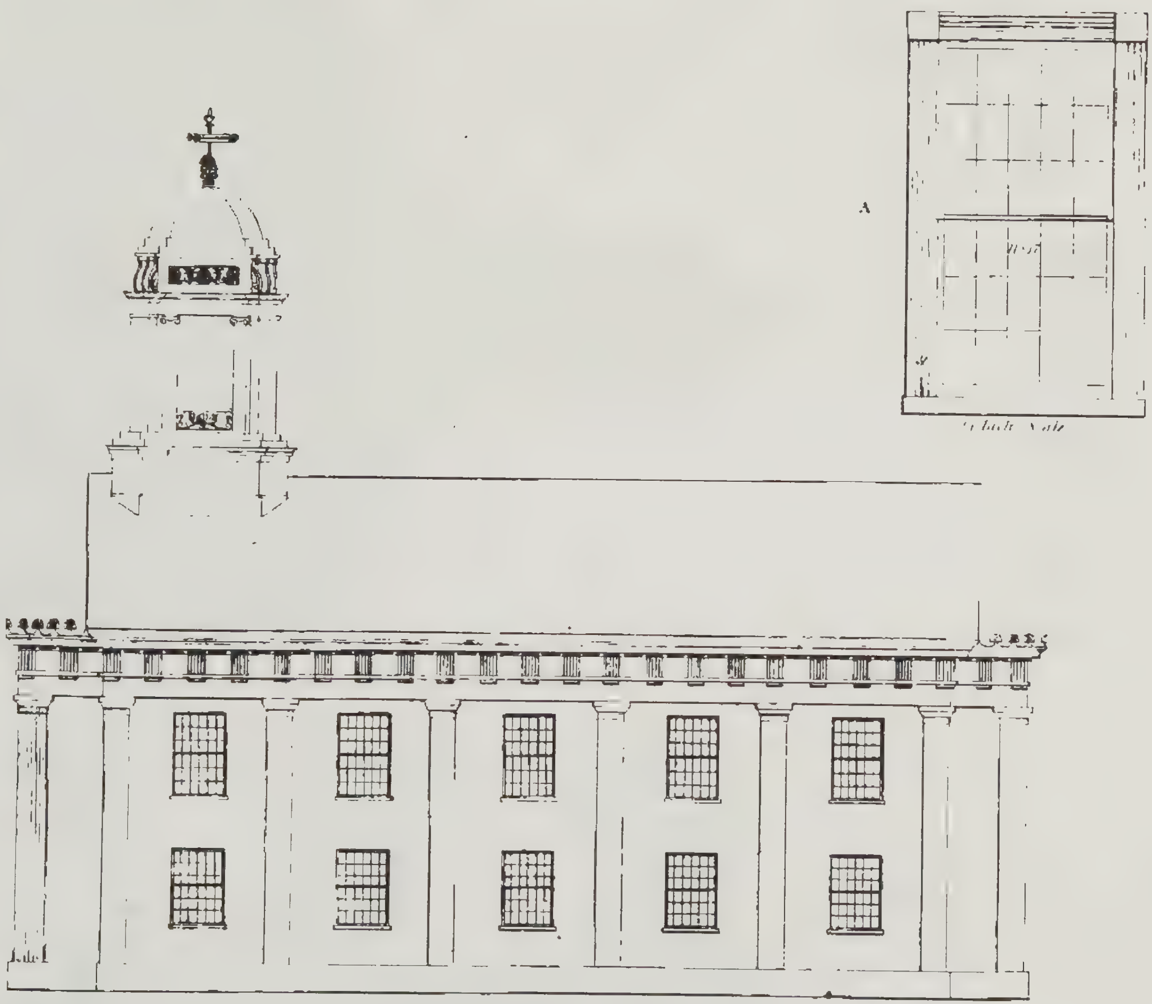
On Plate LIII. is exhibited a front elevation, with the scale of feet by which it is drawn annexed. D shows a plan, and C an elevation of the cupola, drawn from a scale of one eighth of an inch to a foot, figured in feet and inches.

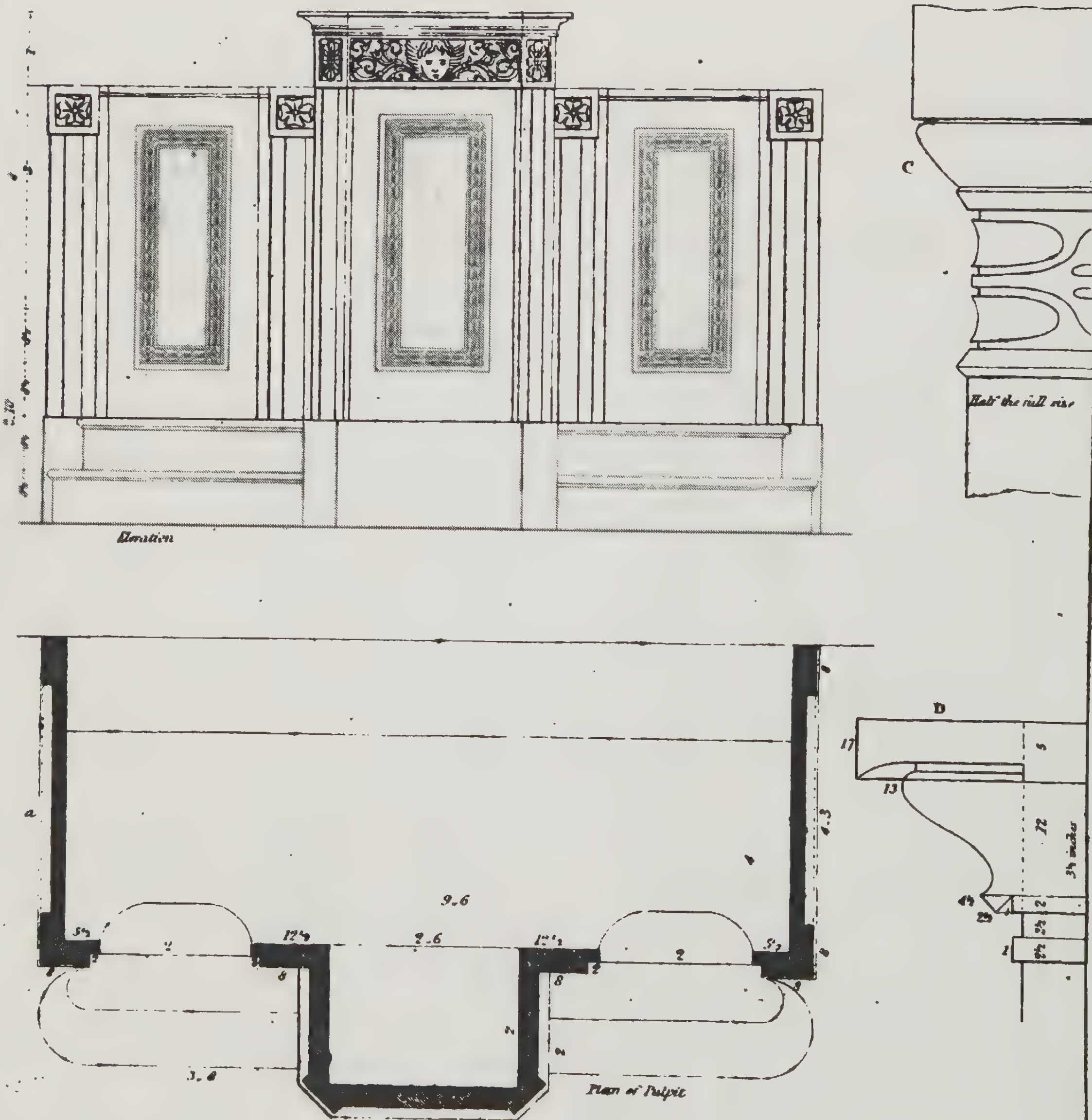
A exhibits an example of the vane and the iron work connected with it, drawn from a scale of one fourth of an inch to a foot, figured in feet and inches; and B, an example of the honeysuckles which are to decorate the upper extremity of the cornice to the portico, figured in minutes.

On Plate LIV. is a side elevation, and at A an example of one of the second story windows, drawn from a scale of one fourth of an inch to a foot.


A
B
C
D

SIDE ELEVATION.




Elevation
C
Half the full size
D
a
9.6
2.6
2
3.6
3
Plan of Pulpit
3½ inches

On Plate LVII. at fig. 4, is exhibited an example which shows the construction of the timber work of the roof of this church, and a plan and elevation of the frame of the cupola. The details which are represented here show the best method of framing the various joints in the roof. They are drawn from a scale of one fourth of an inch to a foot, and figured in feet and inches; which will render them sufficiently plain.

PRACTICAL CARPENTRY.

The principles of this science should be familiar to every practical carpenter. Carpenters who do not profess a thorough theoretical knowledge of their art, are apt either to load their work with timbers unnecessarily large and expensive, or on the other hand to provide timbers too small and weak to resist, for a sufficient length of time, the strain imposed upon them. A knowledge of the stiffness of timber and other materials employed in Carpentry, theoretically as well as practically, will be of the highest utility. This information is furnished by the results of various experiments, made for the purpose of ascertaining the different strains which different sizes of those materials can bear, by several scientific gentlemen of Europe. Of course these experiments were made on European timber. We therefore must make proper allowances for the difference of timber. Different individuals have arrived at

different results in their experiments. We cannot, therefore, put implicit confidence in any of them; but taking them collectively, and making proper allowances for difference in timber, we may assist our judgment and obtain correct views on the subject.

The principal strains to which timbers and other materials are exposed, are the following:

First, that strain by which a beam is drawn in the direction of its length. The strength by which the beam resists this strain, is called its cohesion. The experiment by which the cohesive power of a beam or stick of known dimensions is ascertained, is easily performed in the following manner. The stick is suspended vertically by one extremity, and to the lower extremity are attached weights, which being increased until the stick breaks, thus determine its cohesive power. To this strain, king posts, tie beams, &c. are liable.

The second strain is when the load tends to compress the beam in the direction of its length. To this strain, truss beams, pillars, struts, &c. are exposed.

The third strain is when the load tends to break the beam across. This is called a cross or transverse strain. To this strain all kinds of bearing timbers are liable.

The following list, which gives the cohesive strength of several beams and bars an inch square, is taken from one made by Mr. Emerson. The rod of cast iron is taken from the experiments of Rennie. The amount placed opposite each kind expresses its cohesive strength, or the weight which will be required to break it when drawn in the direction of its length.

Iron Rod an inch square will bear . .	76,400	pounds.
Cast Iron " " "	18,656	"
Brass " " " . . .	35,600	"
Hempen Rope " " . . .	19,600	"
Ivory " " " . . .	15,700	"
Oak, Box and Plumtree " . . .	7,850	"
Elm, Ash and Beech " . . .	6,070	"
Walnut and Plum " . . .	5,360	"
Red Fir, Holley and Crab " . . .	5,000	"
Cherry and Hazel " . . .	4,760	"
Alder, Asp, Birch and Willow . . .	4,290	"
Lead	430	"

It is also given as a practical rule by Mr. Emerson, that a cylinder whose diameter is six inches, will carry, when loaded to one fourth of its absolute strength, as follows. Iron, 135 cwt. ; Good Rope, 22 cwt. ; Oak, 14 cwt. ; Fir, 9 cwt.

By these experiments we see what an immense load a rod of one inch square is capable of suspending. And we likewise see that this strain is not likely to be overrated in practice.

Suppose it required to know the weight that an oak joist of three by four inches will sustain. Multiply the depth by the breadth of the joist in inches ; and that product, which is twelve, by the number of pounds set against oak in the table, 7850. The product, 94,200 pounds, is the answer.

We now come to the second strain, that of compression in the direction of its length. But few experiments on this strain have been made, and the results of those few do not agree. It is maintained by some writers that the resistance to compression is about equal to that of extension ; but the experiments of Du Hamel on cross strain, seem to prove that the resistance to compression is not

more than two thirds of that to extension. It is however fortunate for the practical workman that this strain is not often overrated; for it rarely happens in practice that a body employed to sustain a heavy load is found insufficient for that purpose.

According to Mr. Rondelet's experiments on cubic inches of oak, it required from 5000 to 6000 pounds to crush a piece of that size; and under this pressure its length was reduced more than one third.

Mr. Rennice's experiments produced results considerably lower. A cubic inch of elm was crushed by 1284 pounds; American pine by 1606 pounds; and English oak by 3860 pounds.

We now come to the cross strain, to which all bearing beams, joists, &c. are liable. The resistance to this strain is much less than that of either of the others.

A Table of the Cross or Transverse Strain of different kinds of Wood, each Piece being one foot long, one inch broad, and one inch deep.

Oak	660	pounds.
Ash	635	"
Beech	677	"
Elm	540	"
Walnut, green	487	"
Spruce, American	570	"
Hard Pine, do.	658	"
Birch	517	"
Poplar, Lombard	327	"
Chestnut	450	"

The above table is selected from Tredgold's Carpentry. It expresses the breaking weight of each piece. It will not, therefore, be proper to permanently load either of the pieces with more than

one half of the breaking weight. The effect of this strain produces, on the upper part of the beam, a compression in the direction of its length; and on the under part, an extension in the direction of its length. To illustrate this subject more fully, I will here introduce some of Du Hamel's experiments on the stiffness of beams, the results of which ought to be well understood.

Du Hamel took six bars of willow, three feet long and one and one half inch square. After suitable experiments, he found that they were broken by 525 pounds on an average. Six bars were next cut through with a saw one third of the depth from the upper surface, and each cut was filled with a wedge of dry oak, inserted with a little force. These were broken by 551 pounds on an average. Six other bars were broken through by 542 pounds on an average, after being cut half through and filled up in a similar manner. Six other bars were cut three fourths through, and broken by the pressure of 530 pounds on an average. A baton was then cut three fourths through, and loaded until nearly broken. It was then unloaded, and a thicker wedge was introduced tightly into the cut, so as to straighten the bar by filling up the space left by the compression of the wood. In this state the bar was broken by 577 pounds.

From these experiments we perceive that more than two thirds of the thickness of a beam contributes nothing to its strength. And here we also see, that the compressibility of this kind of strain appears much greater than its dilatability, which circumstance greatly increases its power of withstanding a transverse strain.

We see likewise that gains may be cut from the upper surface of a beam downwards, to one third or one half of the depth, and joists inserted tightly therein, without reducing the strength of the beam. Observe, however, that the size of the joists is not reduced by

shrinkage. It is worthy of remark, that in all the experiments made for ascertaining the resistance to pressure, the strength of the beam is found to be as the breadth and square of the depth directly, and inversely as the length. The strength of a beam therefore depends chiefly on its depth, or rather on that dimension which is in the direction of the strain. If a beam two inches deep and one broad support a given weight, another beam of the same depth and double the breadth will support double the weight. But if a beam two inches deep and one inch broad support a given weight, another of four inches deep and one inch broad will support four times the weight. Hence, beams of equal breadths are to each other as the square of their depths. Again, if a beam of a given cross section and one foot long support a known weight, another beam of the same cross section but two feet long will support only half the known weight.

Buffon's experiments, which were made on large scantlings, and were therefore free from those irregularities unavoidable on small specimens, would seem to show that the strength diminishes in a ratio greater than the inverse proportion of the length. Both reason and experience seem to confirm the truth of these experiments.

A simple arithmetical rule, derived from these experiments, is therefore given, by which the breaking weight of any scantling, the breadth, depth and length being given, may be known. Divide the breaking weight by the length in feet; subtract 10 from the quotient; multiply the remainder by the breadth, and that product by the square of the depth, both expressed in inches. The result is the greatest load in pounds.

For example. Required the resistance of a spruce joist 17 feet long, 12 inches in depth, and 2 inches in breadth. The breaking weight placed against spruce in the above list is 570. Divide 570

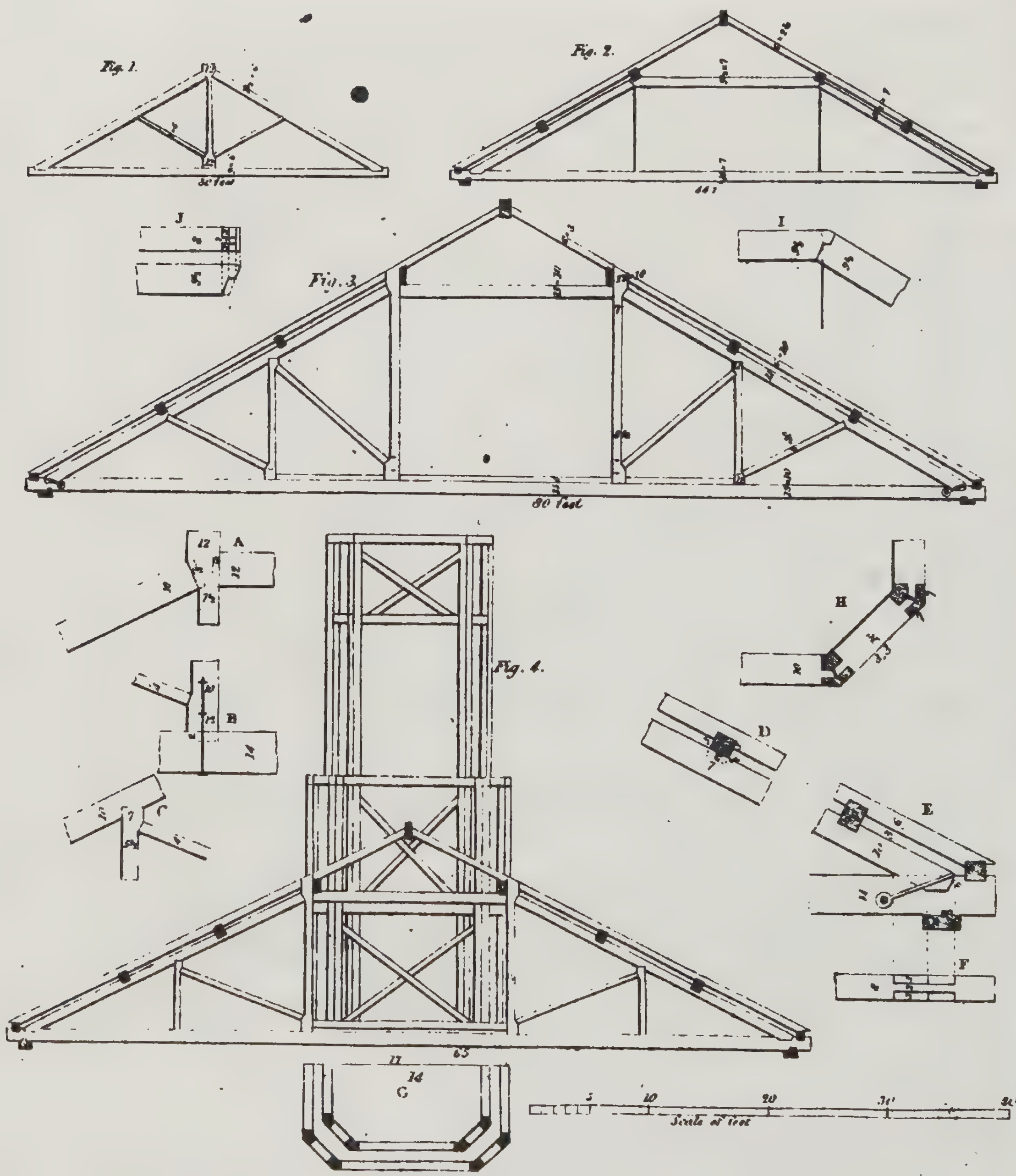


Fig. 1.
30 feet
Fig. 2.
44 f
Fig. 3.
80 feet
J
I
A
B
C
H
D
E
F
G
Fig. 4.
65
Scale of feet

by 17, the length in feet, and you have 33 for the quotient nearly. Subtract 10 from 33, and the remainder is 23. This remainder being multiplied by 2, the breadth in inches, the product is 46. Multiply this product by 144, the square of the depth in inches (the square of any number being obtained by multiplying it by itself), and you have 6624 for the answer. I have left out the fractions in the above operation, knowing that any deviation which makes the result smaller, is on the safe side. *Ans.* 6624.

Required the resistance of a hard pine beam, 20 feet long, 12 inches in depth, and 10 inches in breadth. *Ans.* 31,680.

We must recollect that all the experiments, from which the above results are obtained, were made on wood of the most perfect kind, free from knots, shakes, spots, or rot, and not cross-grained, &c. Every practical workman knows that in roofs, floors, or any other piece of framing of any considerable magnitude, such perfection in timber cannot be expected. It will be wise in him, therefore, to make all due allowance for imperfections in timber.

PLATE LVII.

Fig. 1 exhibits an example of a truss simply constructed for a roof of 30 feet span. I shall describe the different strains to which this truss is liable, and the best means of resisting them.

If a load be laid on the rafters of this truss, it is evident that the downward pressure will cause the heads of the rafters to press hard against the king post, and the lower ends to press equally hard against the abutment at each end of the tie beam. The rafters are thus strained by a compression in the direction of their length; and if no other strain were to be resisted, a stick of timber of small dimensions would be sufficient. But it is evident that a cross strain is

also to be provided for. The latter strain must be resisted by struts, and by making the rafter of a size equal to the resistance of that strain. The pressure of the rafters against the abutment at each end of the tie beam, causes that beam to be strained by an extension in the direction of its length ; and moreover the load laid upon this beam, together with the ceiling which is suspended from the under surface, produces a cross strain, which must be resisted by suspending this beam by the king post, and by making it, as in the case of the rafters, of sufficient size to resist the pressure.

The strain on the king post is an extension in the direction of its length. A small piece of timber is therefore adequate to resist that strain; for we have seen that an oak joist of three by four inches is capable of suspending 94,200 pounds. The pressure of the rafters against the head of this post being very great, they will be apt to indent themselves into the head of the post, and cause a small settlement of the roof, unless the post be made of hard wood. But let it be observed, moreover, that this part of the king post should be made as small as the strain on the post will admit ; otherwise the shrinkage of the post will produce the same effect as the indentation of the rafters. The strain on the strut is wholly that of a compression in the direction of its length, which a small piece of timber will be able to resist.

Having now given the theory of the principal strains of this section, we will give some practical advice in relation to the execution of the work. All bearing joints ought to be made at right angles with the strain. A exhibits the best method of constructing the joints at the head of the rafter and at the ends of the straining beam when they butt against the queen post. The dotted lines show the length of the tenon, which need not be more than one and one half of an inch in length, but must be made to fit the mortice in the

most perfect manner. The bearing surfaces of the post, rafter, and straining beam, should be in one even plane, that the joint may be perfect throughout its whole surface. The ends of the tenons should likewise fit exactly at the bottom of the mortice. Pins are not required here. These observations are intended to apply to all other joints in framing.

B exhibits the method of connecting the foot of the king post to the tie beam. The tenon in this case is only two inches long. The bolt shown here is intended for a large roof, where two nuts are required, and in this case need not be more than one and one eighth of an inch in diameter. It will require a thick, strong head and nuts, three-fourths or seven-eighths of an inch in thickness; and care should be taken that the thread be of a suitable size and well cut, and that the iron of which they are made is of the best quality. We shall not doubt that the size here mentioned is sufficient, when we consider that a bar of iron one inch square is capable of suspending 76,400 pounds.

C exhibits a method of connecting the head of the queen post to the principal rafter. The tenon in this case is not required to be more than one and one half of an inch, and this length is quite sufficient for the tenon at the head and foot of the struts. E exhibits an elevation of a part of the tie beam, the principal and small rafter, a section of the plates and purloins and method of connecting them together; also the best way of securing the foot of a principal rafter by an iron strap. F shows the upper surface of a part of the tie beam. Two inches in the centre of the beam is left uncut, whilst the wood on each side of it is cut away to form the abutments for the foot of the rafter.

D shows a piece of the principal and small rafters, and a section of the purloin. That part of the purloin expressed by dotted lines

against the principal rafter, is notched on to the rafter, the purloin being nine inches deep. Two and a half inches are cut out of the under surface of the purloin, one half inch out of the principal rafter, and three inches out of the small rafter. The distance between the two rafters is three inches.

Fig. 2 exhibits an example of a truss for a roof of forty-four feet span. It is constructed with iron queen posts as a substitute for wood, and thus avoids the difficulty of shrinkage and indentation of the heads of the queen post. A bar of iron one inch square is sufficiently large to resist any strain which may happen to these posts.

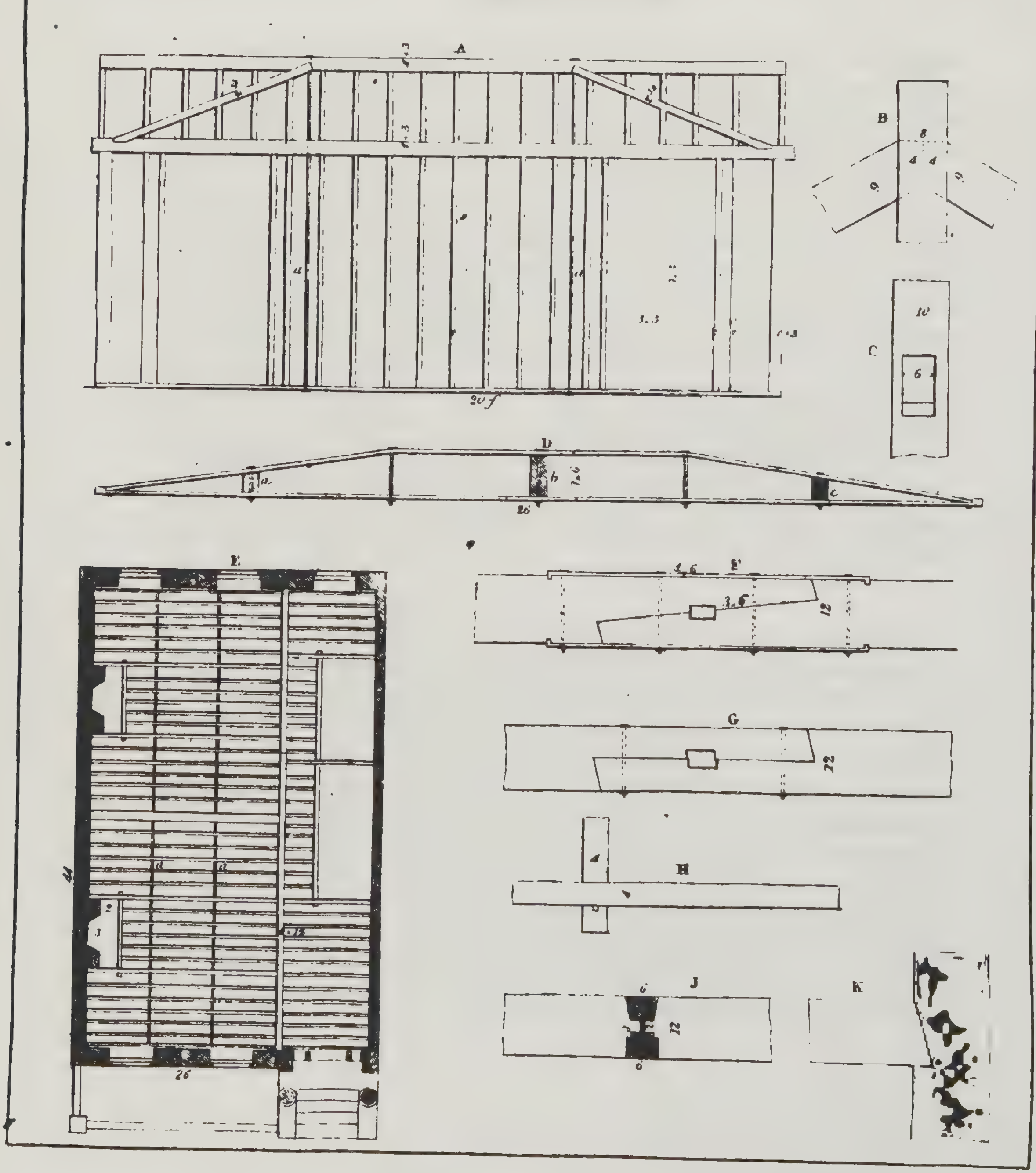
I and J exhibit a method of connecting the heads of the principal rafters with the straining beam.

Fig 3 exhibits an example of a truss for a roof of eighty feet span. The depth of the timbers is figured on the plan, and they may all be nine inches in breadth, except the small rafters, which may be three inches.

PLATE LVIII.

A exhibits an example of a truss partition suitably constructed for a situation where the timbers, either below or above it, require support. The truss being placed over the doors, it does not therefore interfere as to these doors being placed in any situation desired. *a a* show two iron rods, to which the timbers below may be suspended. Three inches is quite sufficient for the thickness of this partition, unless the story be made more than ten feet in height.

B shows a method of framing the principal rafters through the king post, their ends bearing against each other. C exhibits a side


A
B
C
D
E
F
G
H
J
K
20 f
26
44

view of the king post, showing the mortice made through it, which is six inches in breadth, and leaves two inches of wood on each side of it. If this example be faithfully framed, it leaves no chance for shrinkage or indentation.

D shows an example for a wrought iron truss of twenty-six feet span. This truss is capable of being extended to a greater length if desired. *a, b, c,* are pieces of wood used for the purpose of preventing the truss from tumbling.

F and G exhibit different methods of scarfing timbers, figured in feet and inches, and plain to inspection. The ends of the iron straps on F are let into the beam.

E shows the best method of constructing a floor for a dwelling-house. The beam lying under the partition which separates the rooms from the entry, is six by twelve inches; the one in the centre between the rooms and under the sliding doors, ten by twelve; the trimmer joists four by twelve, and the common joists two by twelve.

a, a, show two rows of stiffeners, which may be made with pieces of inch boards that are of little or no value. They should be cut in, so as to make a perfect joint against the sides of the joists, and fitted in with a little force. They should never be omitted in a floor of this sort, where the joists have more than ten feet bearing; for they stiffen and strengthen the floor exceedingly. H shows the method of framing the trimmer joists; J, the joists into the beam; and K, the end of a joist cut so as to rest on a brick wall.

If a floor of a dwelling-house be loaded with people, to which it is always liable, the load is then equal to one hundred and twenty pounds on each square foot; we therefore see that the floor of a room of twenty by seventeen feet, must be capable of resisting a pressure of 40,800 pounds.

The bearing weight of one of these joists (supposing them to be of spruce), is obtained as follows. The breaking weight of spruce is 570. Divide 570 by the length of the joist, which is 17 feet, and you obtain 33 feet nearly (for I leave out the decimals). Deduct 10 from 33, and the remainder is 23. Multiply 23 by 2, the breadth of the joist, and you obtain 46. Multiply 46 by the square of the depth of the joist, which is 144, and you obtain 6624, which is the breaking weight; and the breaking weight of the 20 joists collectively which are in the floor (I call each of the trimmers equal to two common joists), is 132,480 pounds. And they contain 680 feet of timber, board measure.

We will now see, in the same manner, what the resistance to pressure is, of a floor framed in the common way, with a beam lying longitudinally through the centre of the room, twelve inches square, and filled up on each side with joists four by four inches. The breaking weight of the beam, if of spruce, is 31,104 pounds. In this calculation I do not allow any diminution in the strength of the beam on account of the gains cut into it, because if the joists are tightly pressed into the gains and prevented from shrinking, the beam will not be weakened. 31,104 pounds is one half of the ultimate strength of the floor. Double this sum, and you have 62,208 for the ultimate strength of the whole floor. It requires 602 feet of timber, board measure, to complete this floor. By this calculation we see that with the same quantity of timber in the wide joist floor, we have more than double the strength that is obtained by a beam and joist floor.

If a church be made of wood, and without a gallery, it is common to frame the sides with a girt, placed about midway between the plate and the sill. The posts and girts in this case cannot be less than ten inches, and the studs four by four inches. Let us suppose

a building, fifty feet long and twenty-five high, to be framed in this way. The mortice made in the middle of the post cannot be less than two inches ; and the pin-holes, which pass through the tenon of each girt, than two inches more. The tenon and pin-holes reduce the solid part of the post to eight inches, and even less : for, in taking the square of the depth, it must be taken in two parts ; first, from the face of the post to the mortice, two inches, the square of which is four ; and the remaining part of the post beyond the mortice is six inches, the square of which is thirty-six, which with the four added makes forty ; whereas the square of eight is sixty-four.

If these posts be of spruce, the bearing weight of each will be 3840, and collectively 15,360. Double this sum, and we have 30,720 pounds ; which is the ultimate resistance to any strain to which the whole side of the house is liable. The greatest force produced by the wind on a vertical wall is equal to forty pounds on a square foot. It will therefore be unsafe not to afford a resistance fully adequate to overcome that strain. The posts, girts and studs, will contain 2083 feet, board measure. We will now suppose this facade to be framed with spruce studs, twenty-five feet long, two inches thick, and eight inches deep. The breaking weight of one is 1944 ; and of thirty-seven, the number required to complete the side, 71,928 pounds, which is the ultimate strength of the whole side ; and they contain altogether 1354 feet, board measure.

I leave this subject without comment, trusting that the practical workman will see the immense advantage gained by the deep joist and deep stud framing, and decide in their favor.

PLATE LIX.

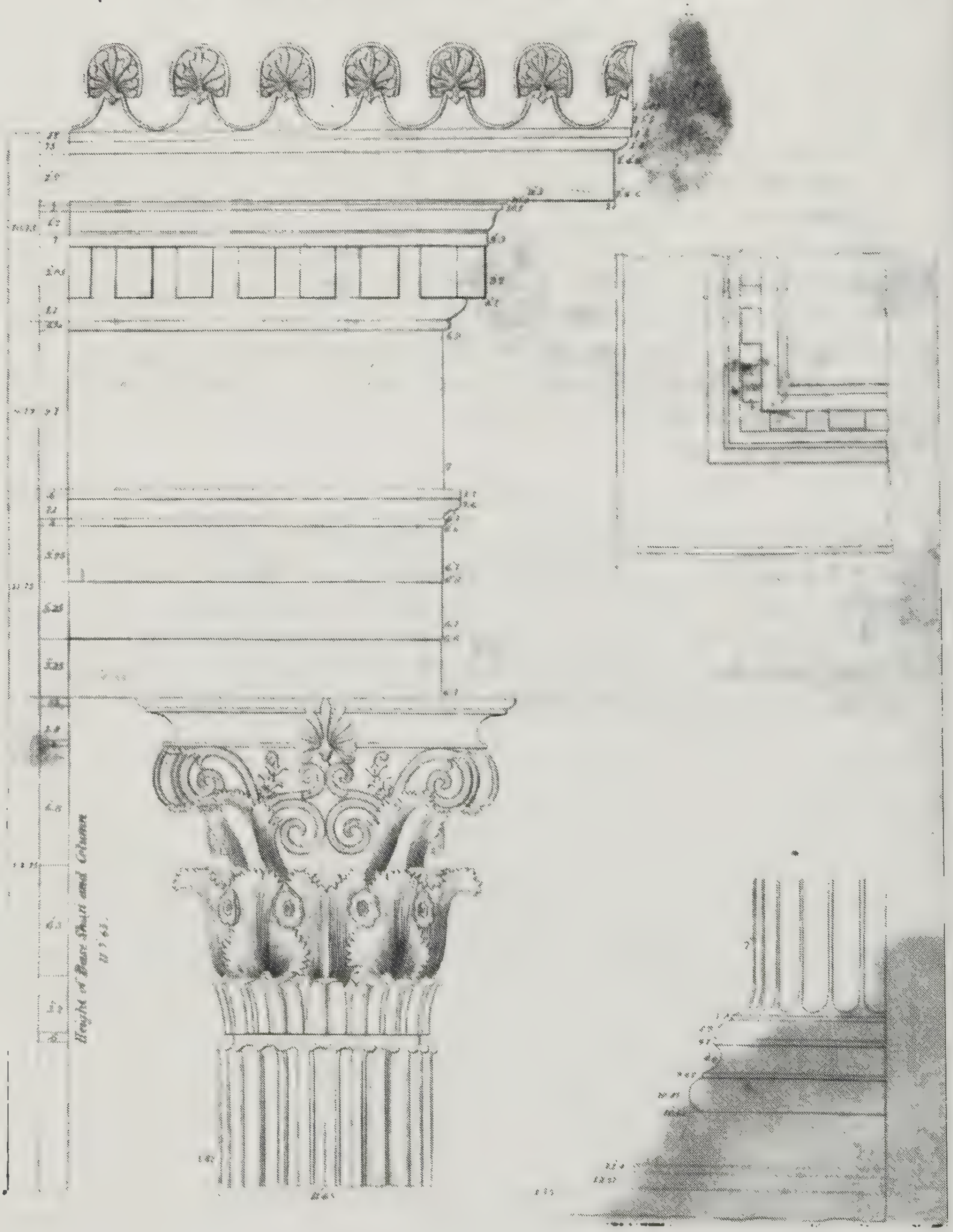
On this Plate is exhibited an example of the Corinthian order, as taken by Stewart & Revett from the Choragic Monument of Lysicrates at Athens. It is figured in feet, inches, and decimal parts of an inch. Had I intended to publish this example at the commencement of the work, I should have given it a place by the side of the Corinthian order ; but as that was not the case, being aware of the high estimation in which this composition is held by the lovers of the art, I have supposed it better to give it a place at the end of the book than not at all.

PLATE LX.

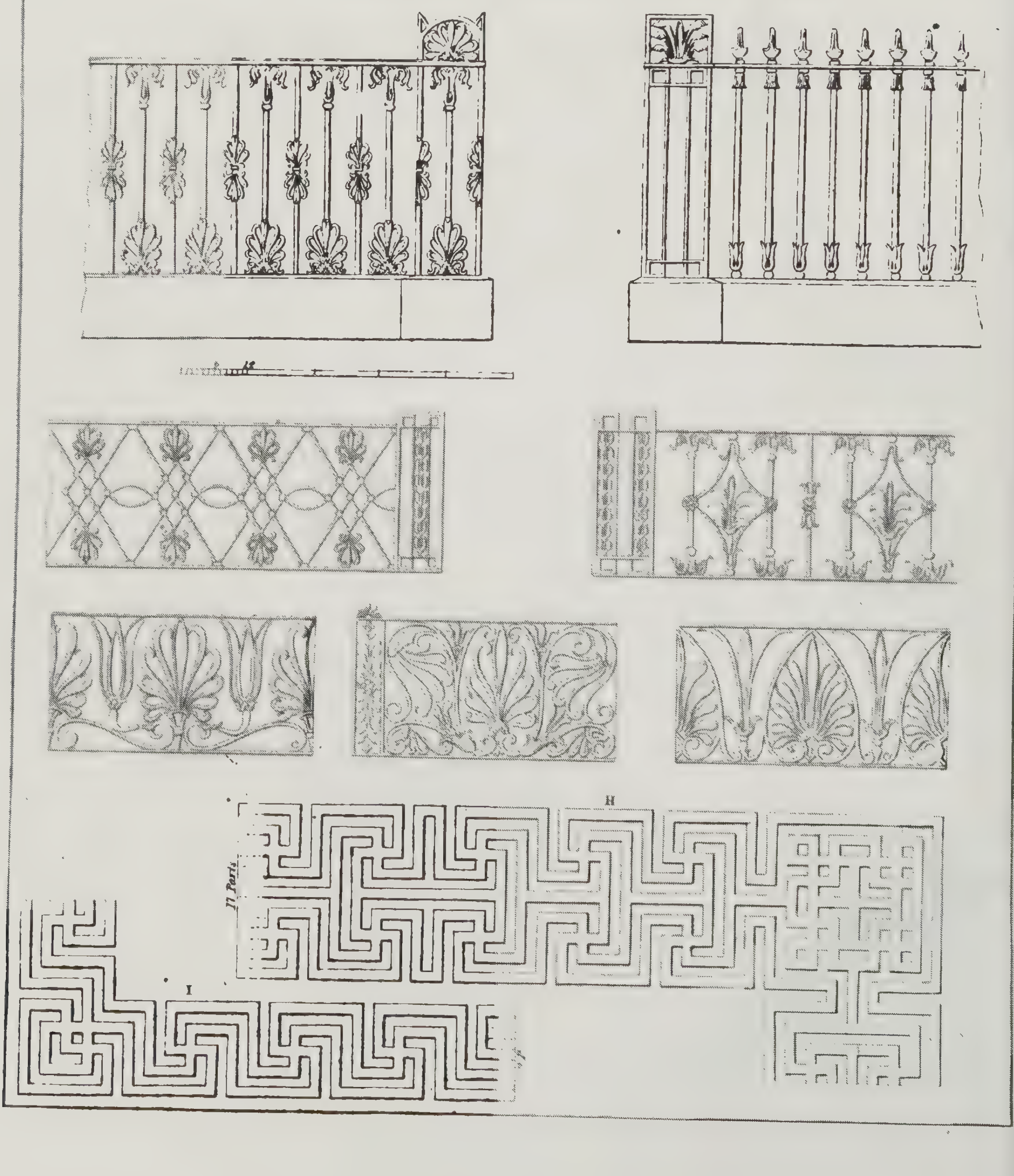
On this Plate is exhibited a series of designs for Fences, Windows, Guards, &c. In this construction a view was had to their being made of cast iron. They are drawn from a scale of one half inch to a foot. H and I exhibit two different examples for frets. H is divided into seventeen, and I into nine parts. I have given here the manner of forming the angle of each design.

THE END.

FROM THE CHORAGIC MONUMENT OF LYSICRATES. Pl. 59.



EXAMPLES FOR FENCES & WINDOW GUARDS.



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